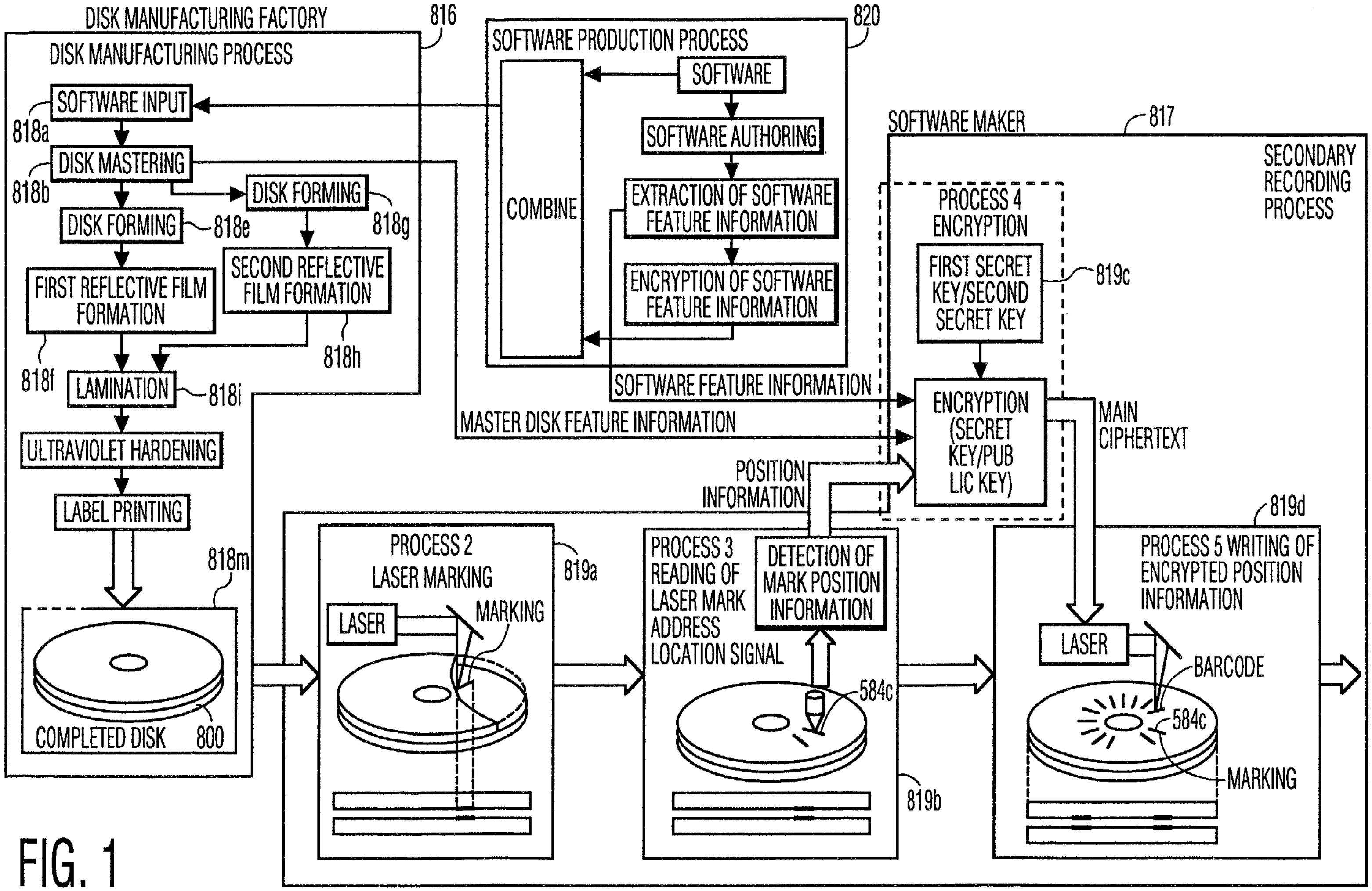

DISK MANUFACTURING FACTORY
816
DISK MANUFACTURING PROCESS
SOFTWARE INPUT
818a
DISK MASTERING
818b
DISK FORMING
818e
DISK FORMING
818g
FIRST REFLECTIVE FILM FORMATION
818f
SECOND REFLECTIVE FILM FORMATION
818h
LAMINATION
818i
ULTRAVIOLET HARDENING
LABEL PRINTING
818m
COMPLETED DISK
800
SOFTWARE PRODUCTION PROCESS
820
SOFTWARE
SOFTWARE AUTHORING
EXTRACTION OF SOFTWARE FEATURE INFORMATION
ENCRYPTION OF SOFTWARE FEATURE INFORMATION
COMBINE
SOFTWARE FEATURE INFORMATION
MASTER DISK FEATURE INFORMATION
SOFTWARE MAKER
817
SECONDARY RECORDING PROCESS
PROCESS 4 ENCRYPTION
FIRST SECRET KEY/SECOND SECRET KEY
819c
ENCRYPTION (SECRET KEY/PUB LIC KEY)
MAIN CIPHERTEXT
POSITION INFORMATION
PROCESS 2 LASER MARKING
819a
LASER
MARKING
PROCESS 3 READING OF LASER MARK ADDRESS LOCATION SIGNAL
DETECTION OF MARK POSITION INFORMATION
584c
819b
PROCESS 5 WRITING OF ENCRYPTED POSITION INFORMATION
819d
LASER
BARCODE
584c
MARKING

FIG. 1

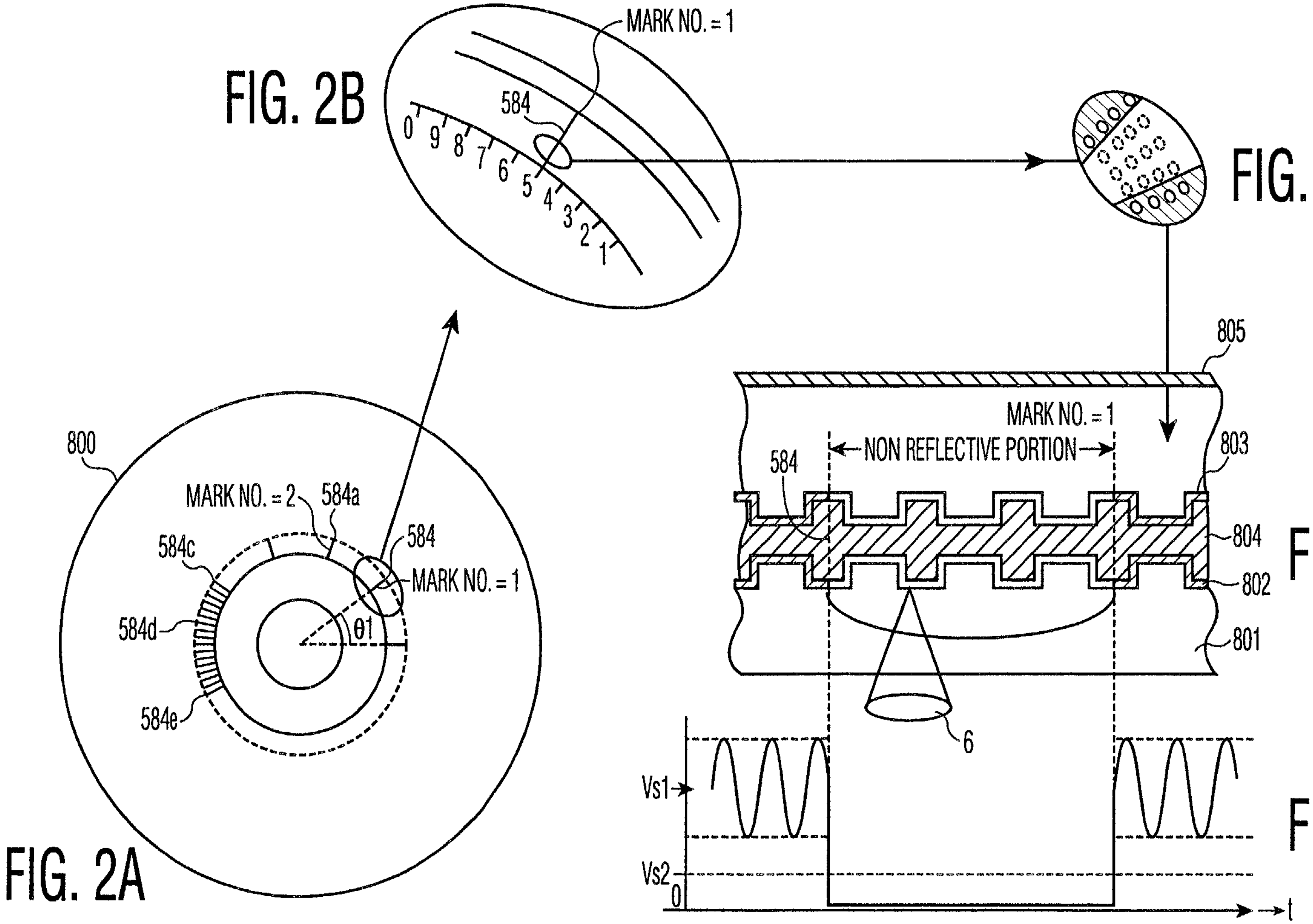


FIG. 2A

FIG. 2B

FIG. 2C

FIG. 2D

FIG. 2E

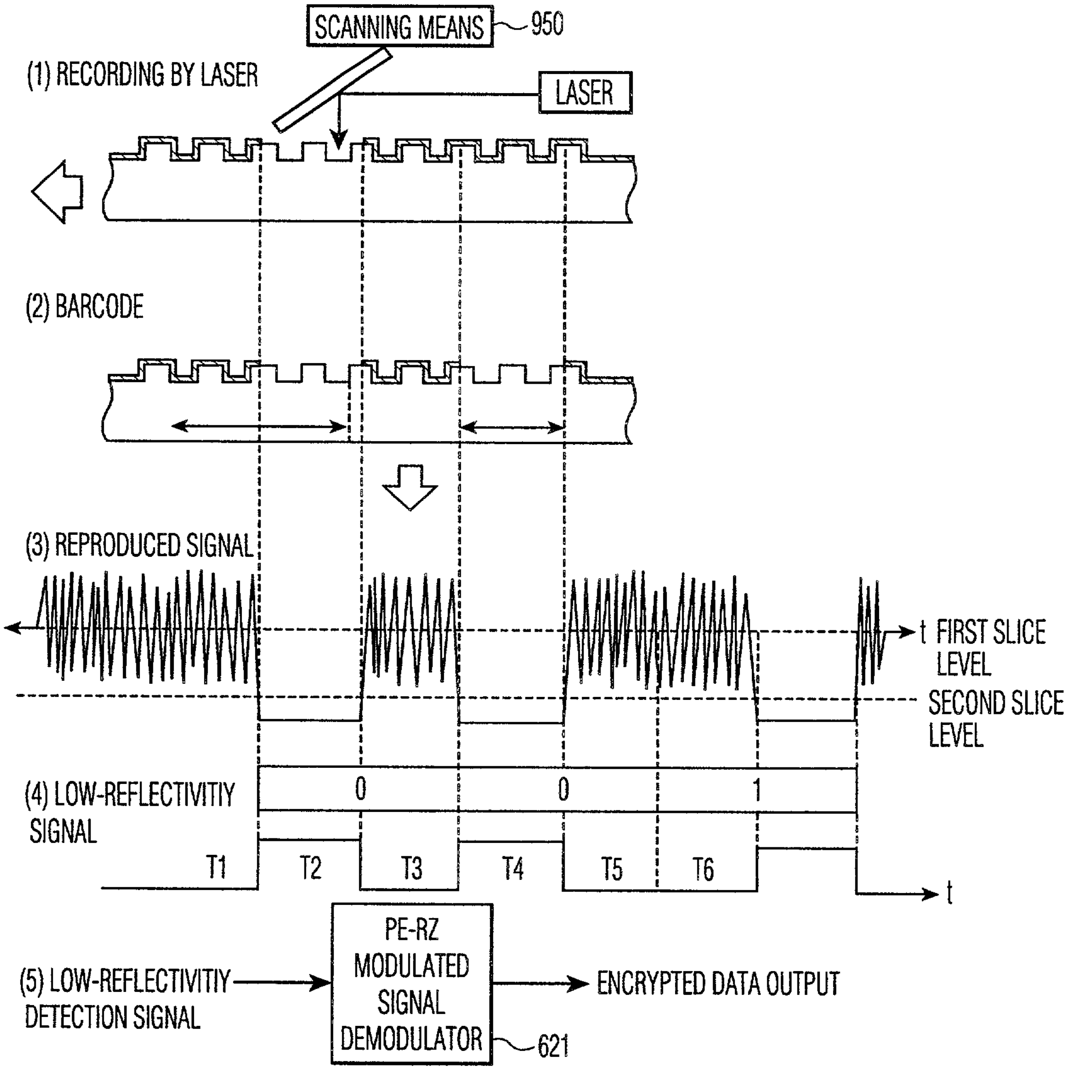

SCANNING MEANS
950
(1) RECORDING BY LASER
LASER
(2) BARCODE
(3) REPRODUCED SIGNAL
t
FIRST SLICE LEVEL
SECOND SLICE LEVEL
(4) LOW-REFLECTIVITIY SIGNAL
0
0
1
T1
T2
T3
T4
T5
T6
t
(5) LOW-REFLECTIVITIY DETECTION SIGNAL
PE-RZ MODULATED SIGNAL DEMODULATOR
621
ENCRYPTED DATA OUTPUT

FIG. 3

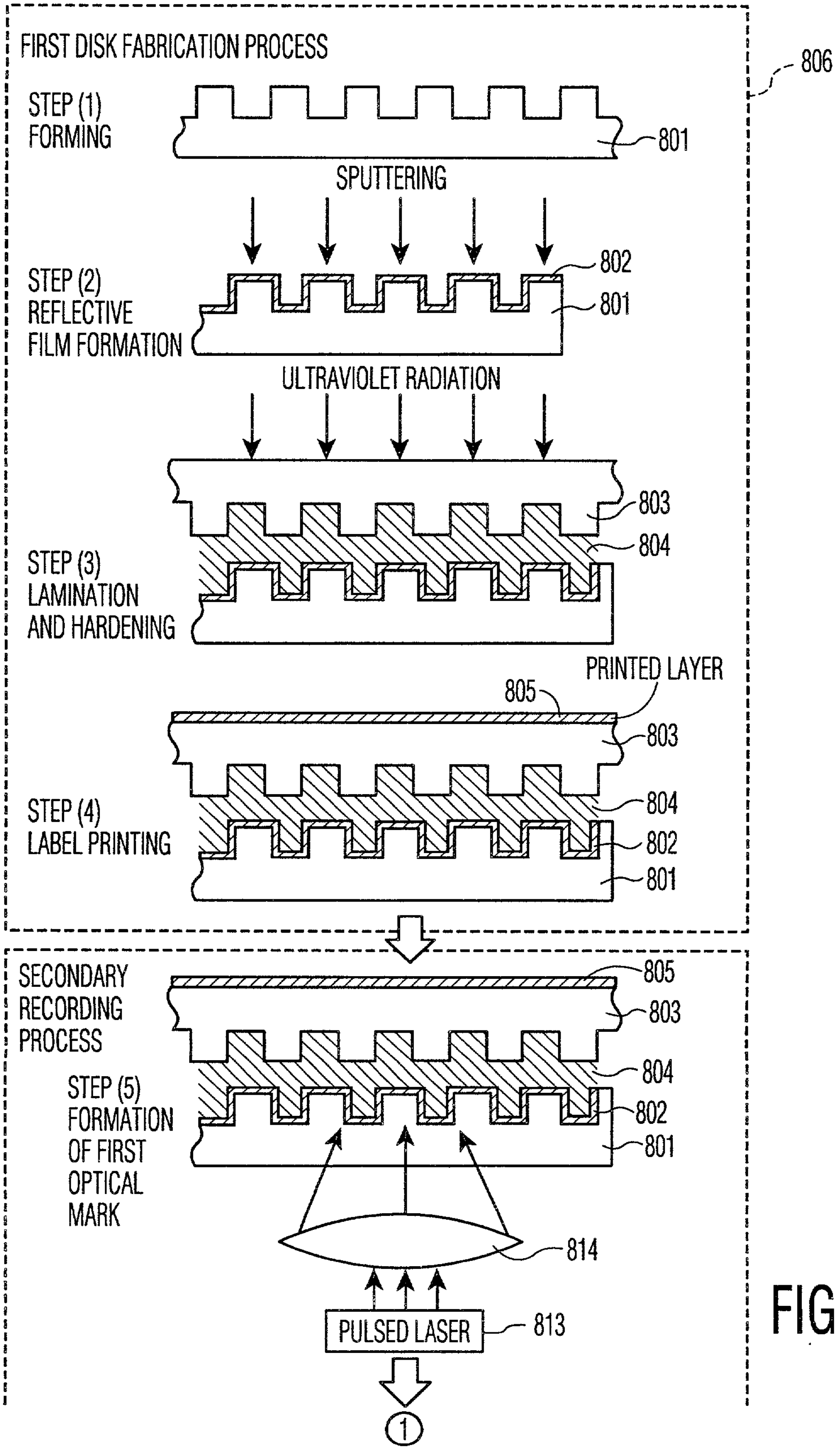

FIRST DISK FABRICATION PROCESS
806
STEP (1)
FORMING
801
SPUTTERING
STEP (2)
REFLECTIVE
FILM FORMATION
802
801
ULTRAVIOLET RADIATION
803
804
STEP (3)
LAMINATION
AND HARDENING
805
PRINTED LAYER
803
STEP (4)
LABEL PRINTING
804
802
801
SECONDARY
RECORDING
PROCESS
805
803
804
STEP (5)
FORMATION
OF FIRST
OPTICAL
MARK
802
801
814
PULSED LASER
813
①

FIG. 4

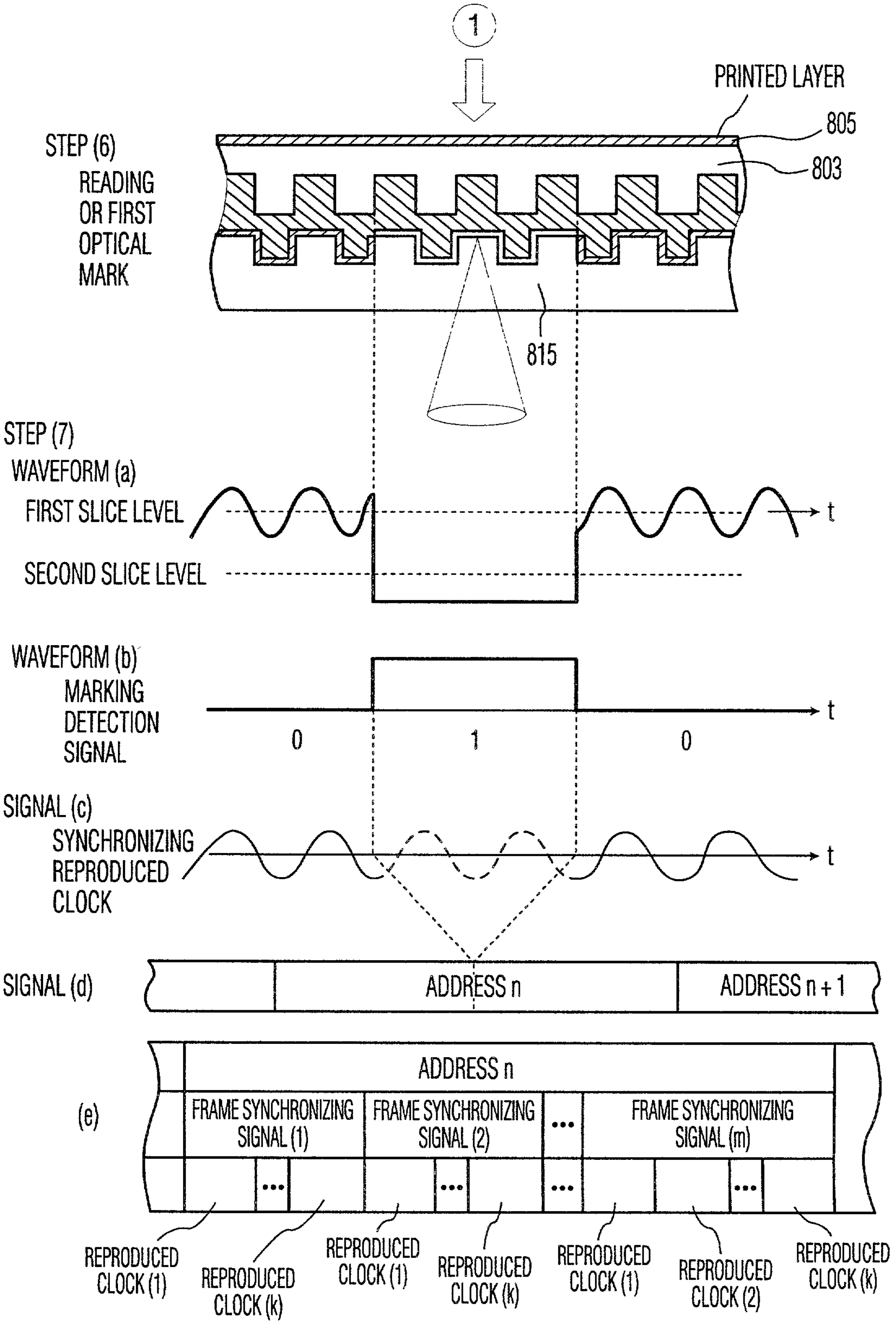

①
PRINTED LAYER
805
803
STEP (6)
READING OR FIRST OPTICAL MARK
815
STEP (7)
WAVEFORM (a)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
t
WAVEFORM (b)
MARKING DETECTION SIGNAL
0
1
0
t
SIGNAL (c)
SYNCHRONIZING REPRODUCED CLOCK
t
SIGNAL (d)
ADDRESS n
ADDRESS n + 1
(e)
ADDRESS n
FRAME SYNCHRONIZING SIGNAL (1)
FRAME SYNCHRONIZING SIGNAL (2)
...
FRAME SYNCHRONIZING SIGNAL (m)
...
...
...
...
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (k)
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (k)
REPRODUCED CLOCK (1)
REPRODUCED CLOCK (2)
REPRODUCED CLOCK (k)

FIG. 5

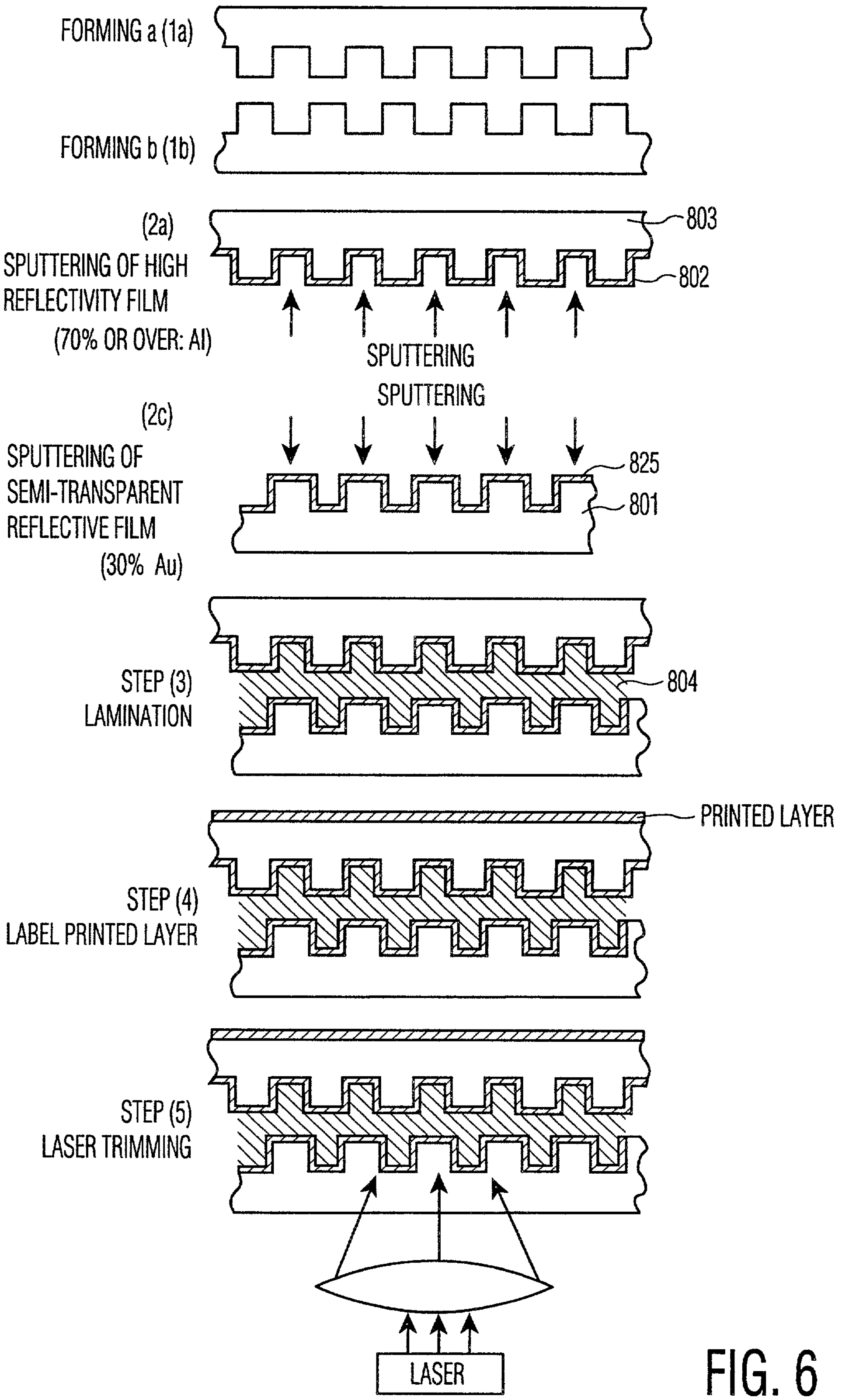

FORMING a (1a)
FORMING b (1b)
(2a)
SPUTTERING OF HIGH REFLECTIVITY FILM
(70% OR OVER: Al)
803
802
SPUTTERING
SPUTTERING
(2c)
SPUTTERING OF SEMI-TRANSPARENT REFLECTIVE FILM
(30% Au)
825
801
STEP (3)
LAMINATION
804
PRINTED LAYER
STEP (4)
LABEL PRINTED LAYER
STEP (5)
LASER TRIMMING
LASER

FIG. 6

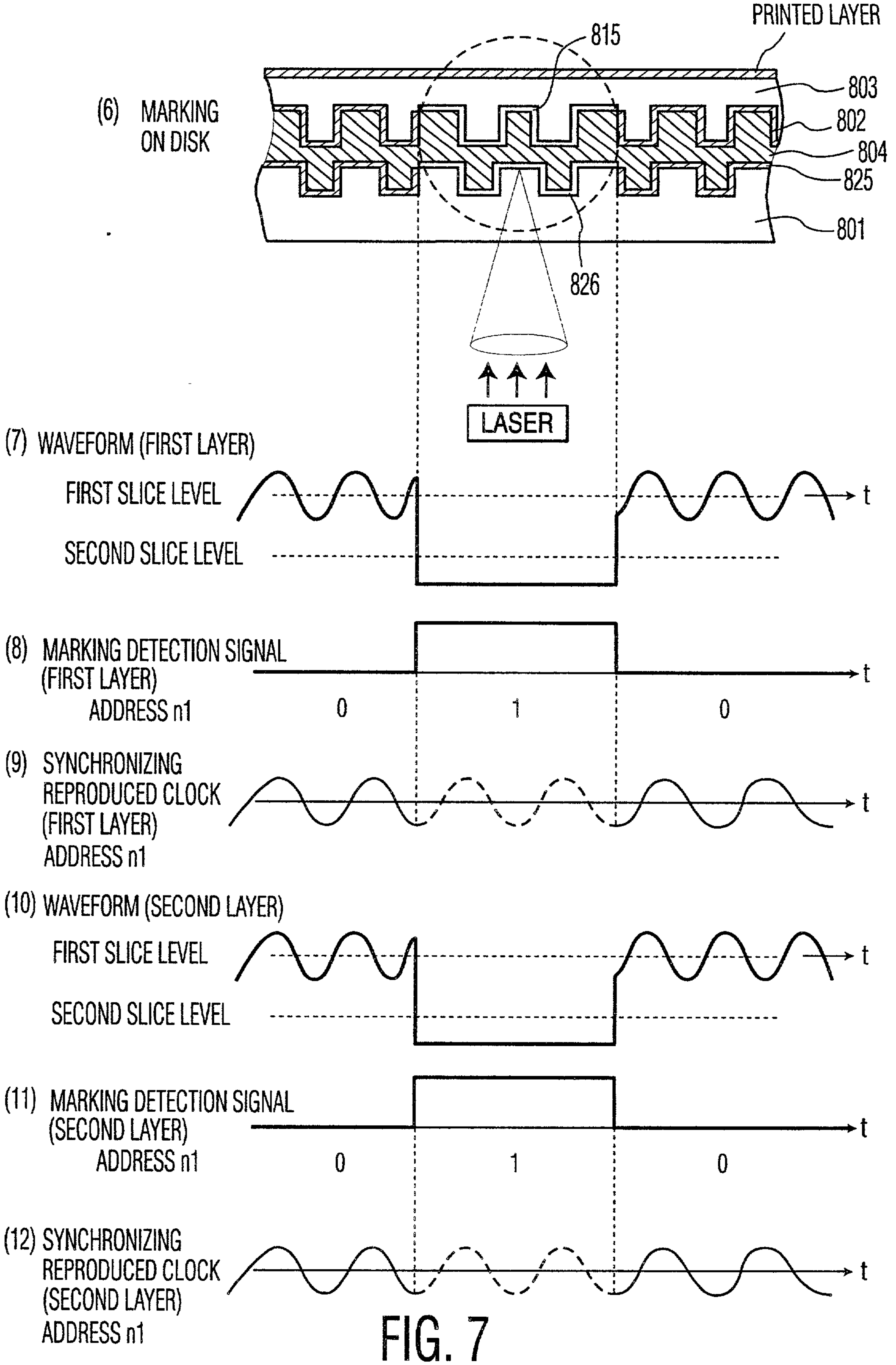

PRINTED LAYER
815
803
802
804
825
801
826
(6) MARKING ON DISK
LASER
(7) WAVEFORM (FIRST LAYER)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
t
(8) MARKING DETECTION SIGNAL (FIRST LAYER) ADDRESS n1
0
1
0
t
(9) SYNCHRONIZING REPRODUCED CLOCK (FIRST LAYER) ADDRESS n1
t
(10) WAVEFORM (SECOND LAYER)
FIRST SLICE LEVEL
SECOND SLICE LEVEL
t
(11) MARKING DETECTION SIGNAL (SECOND LAYER) ADDRESS n1
0
1
0
t
(12) SYNCHRONIZING REPRODUCED CLOCK (SECOND LAYER) ADDRESS n1
t

FIG. 7

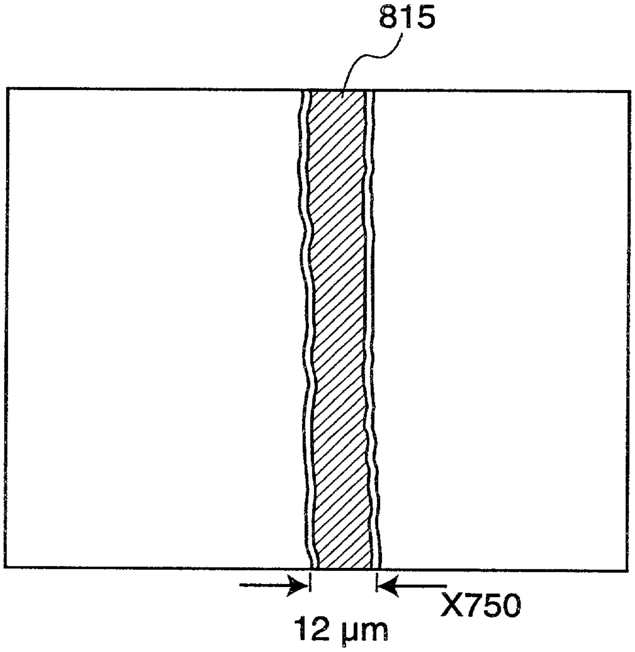


FIG. 8A

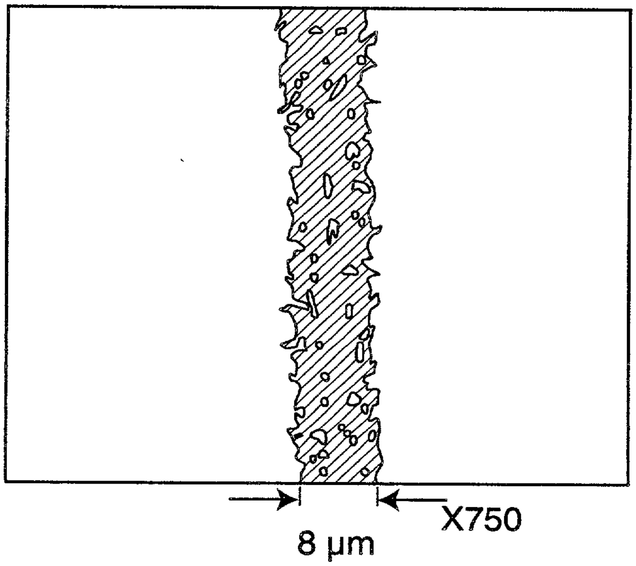


FIG. 8B

FIG. 9A

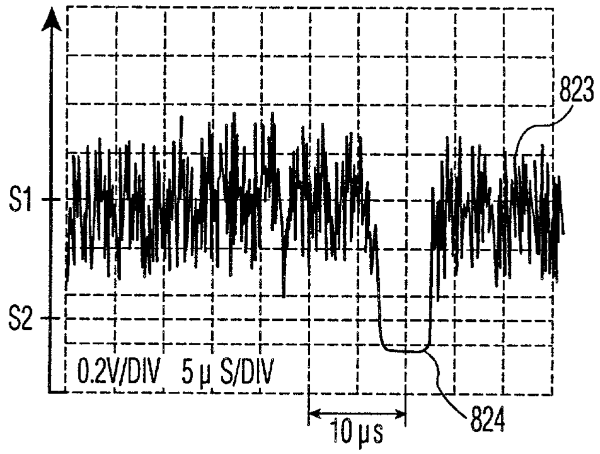


FIG. 9B

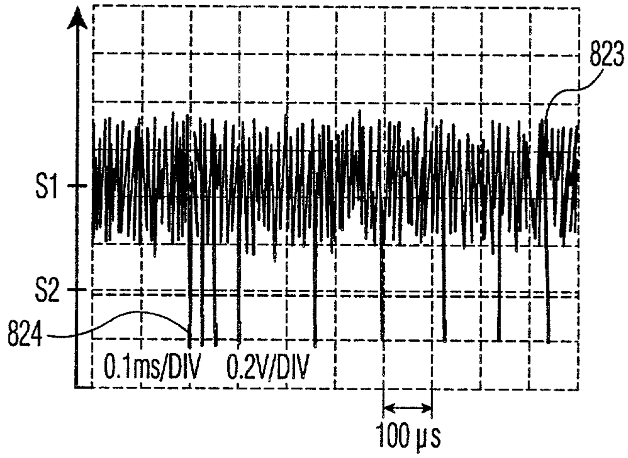


FIG. 9C

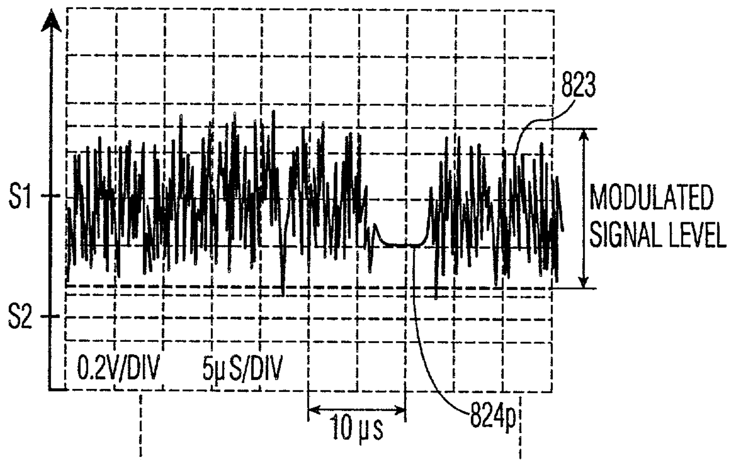
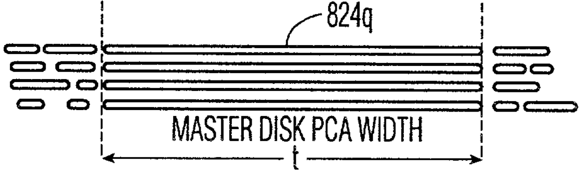


FIG. 9D



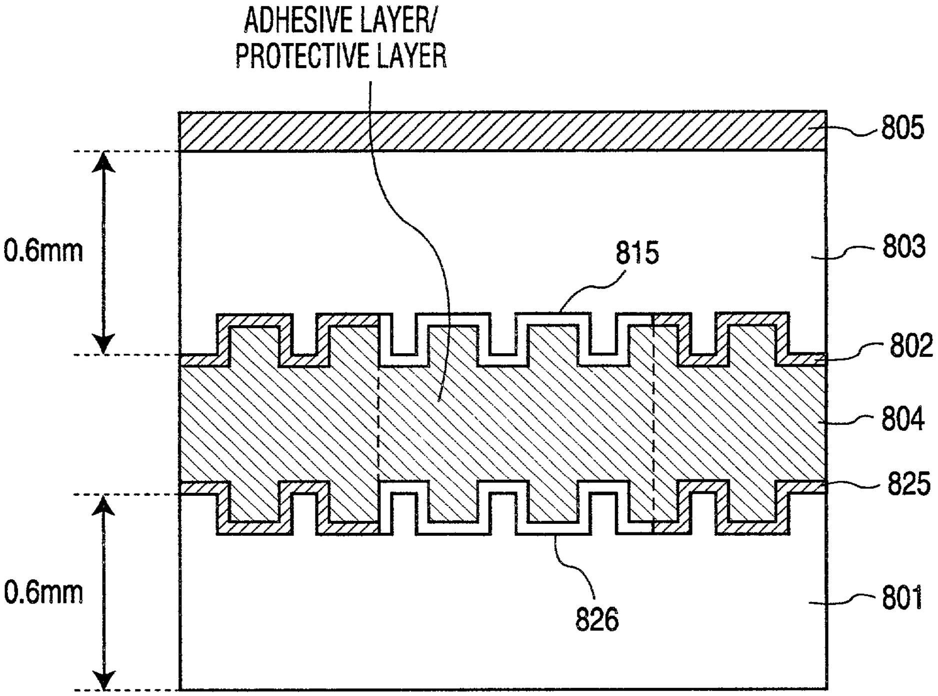


FIG. 10A

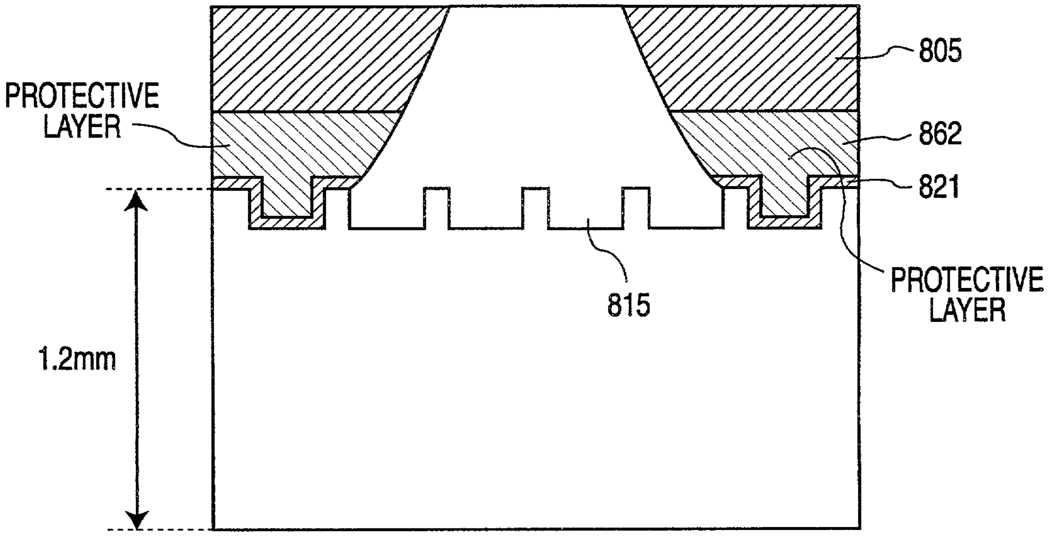


FIG. 10B

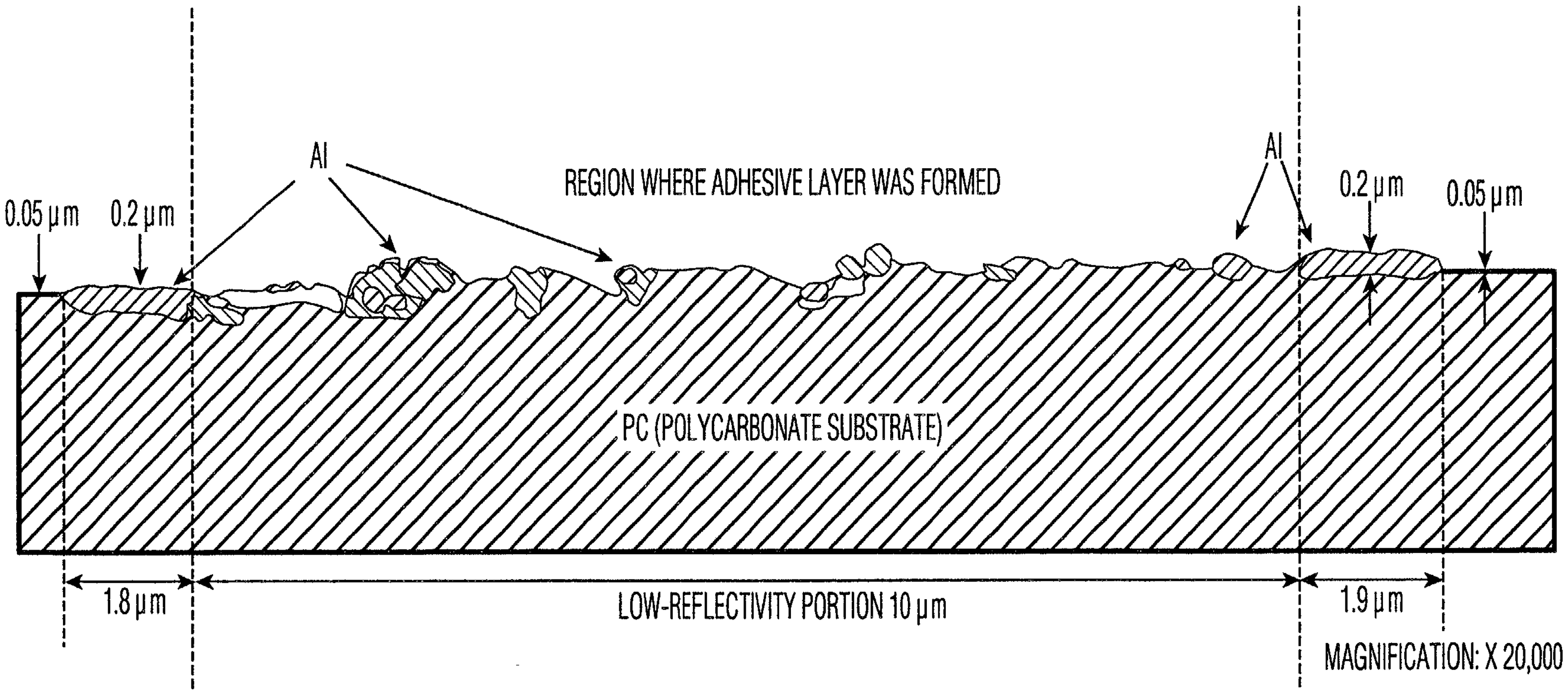

Al
REGION WHERE ADHESIVE LAYER WAS FORMED
Al
0.05 µm
0.2 µm
0.2 µm
0.05 µm
PC (POLYCARBONATE SUBSTRATE)
1.8 µm
LOW-REFLECTIVITY PORTION 10 µm
1.9 µm
MAGNIFICATION: X 20,000

FIG. 11

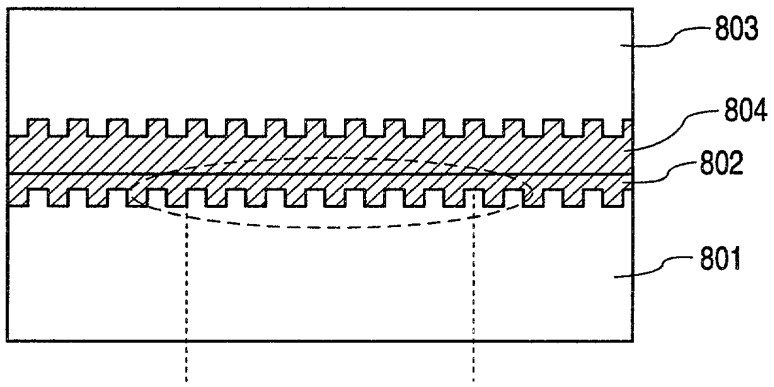


FIG. 12A

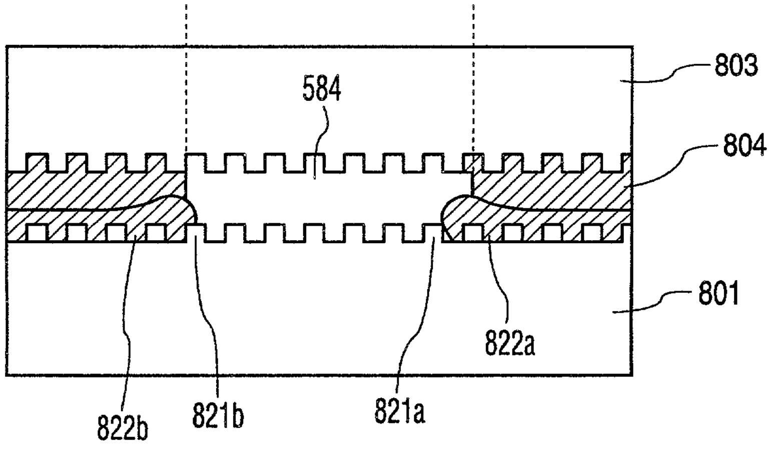
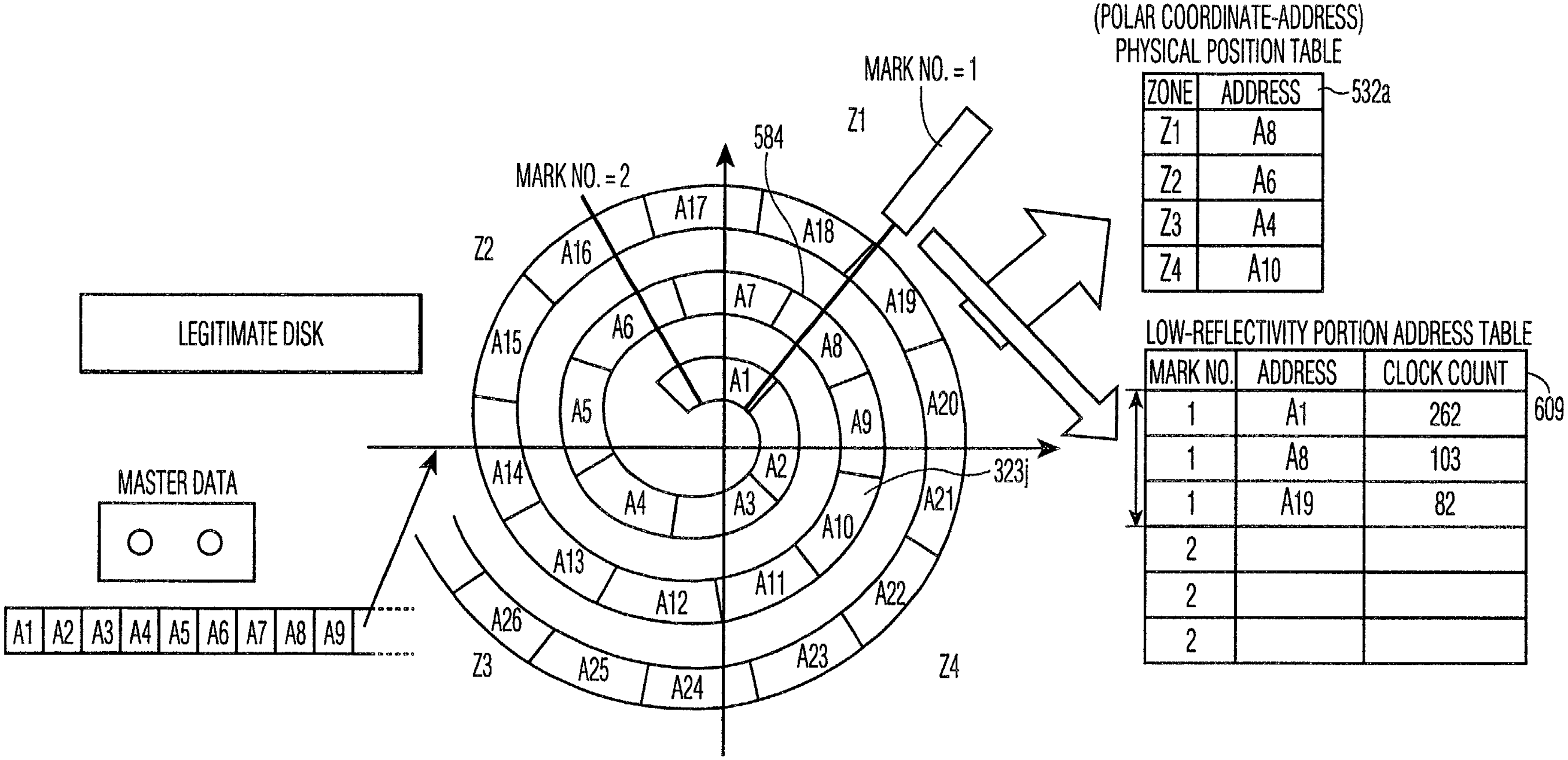


FIG. 12B



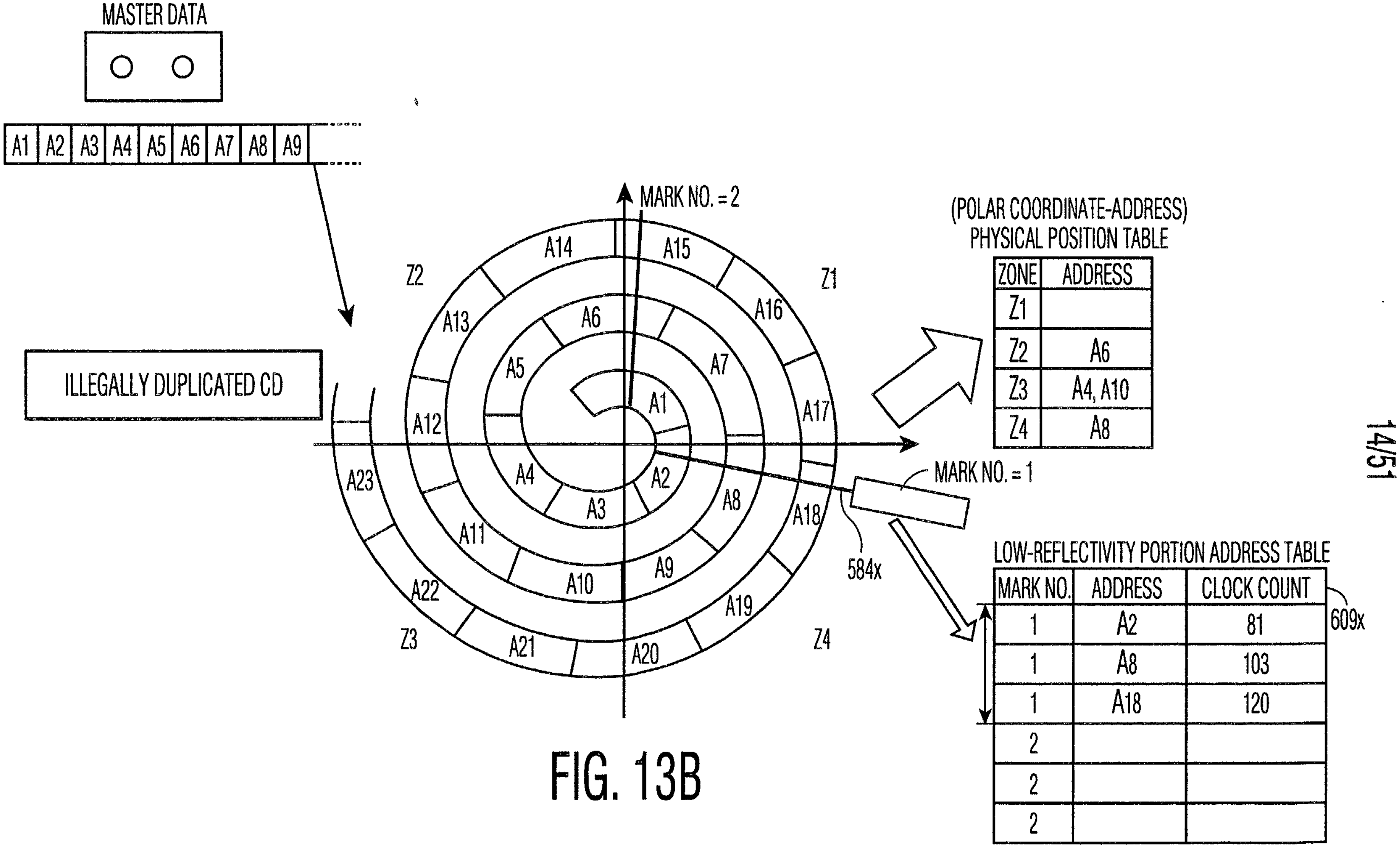
(POLAR COORDINATE-ADDRESS)
PHYSICAL POSITION TABLE

ZONE	ADDRESS
Z1	A8
Z2	A6
Z3	A4
Z4	A10

LOW-REFLECTIVITY PORTION ADDRESS TABLE

MARK NO.	ADDRESS	CLOCK COUNT
1	A1	262
1	A8	103
1	A19	82
2		
2		
2		

FIG. 13A



(POLAR COORDINATE-ADDRESS)
PHYSICAL POSITION TABLE

ZONE	ADDRESS
Z1	
Z2	A6
Z3	A4, A10
Z4	A8

LOW-REFLECTIVITY PORTION ADDRESS TABLE

MARK NO.	ADDRESS	CLOCK COUNT
1	A2	81
1	A8	103
1	A18	120
2		
2		
2		

FIG. 13B

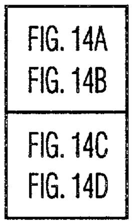


FIG. 14

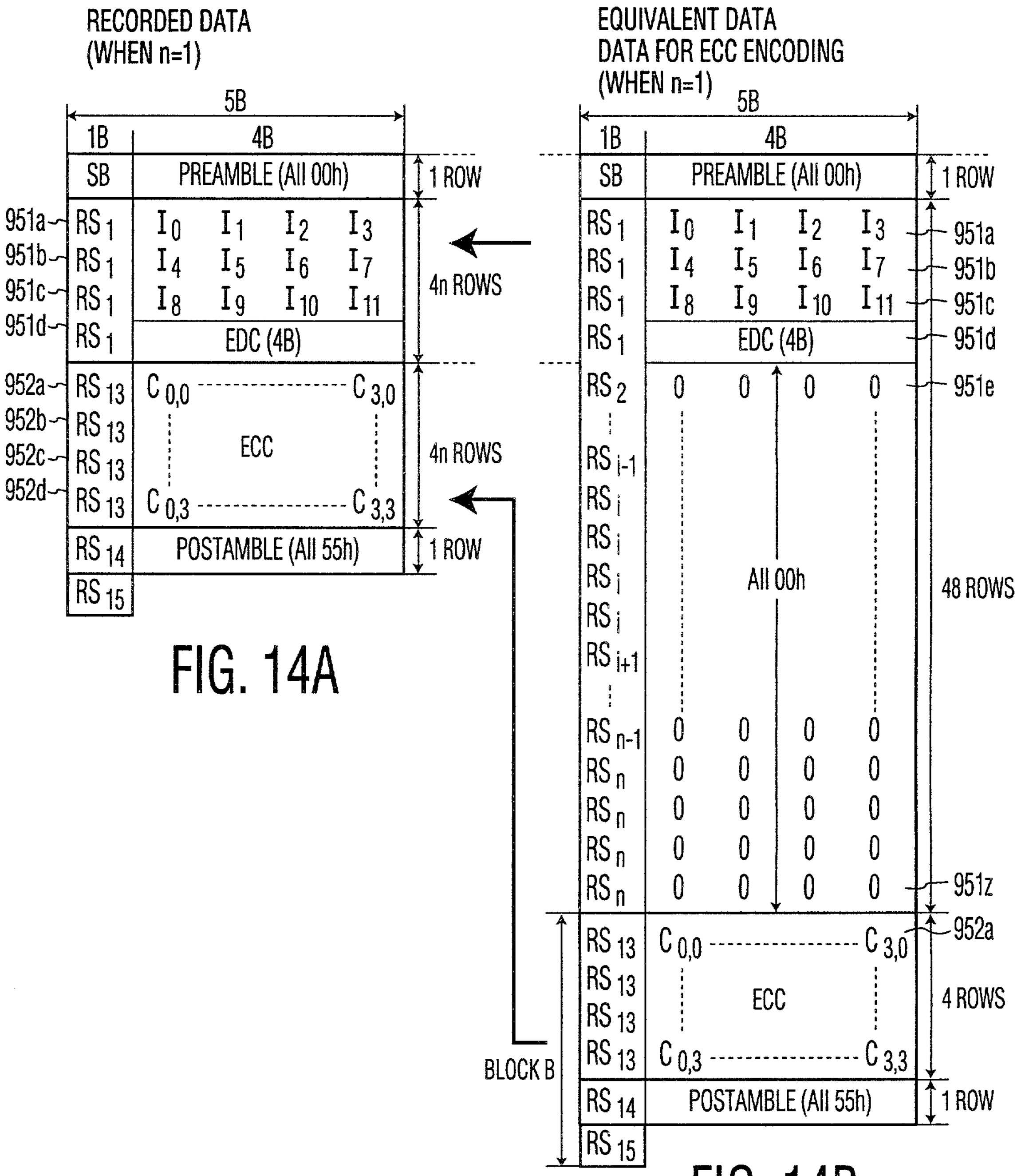


FIG. 14A

FIG. 14B

TYPICAL EQUATION
FOR EDC COMPUTATION
EDC (ERROR DETECTION CODE) :

$$EDC_{PCA}(x)=\sum_{i=0}^{31} bi \bullet x^{i}$$

$$I_{PCA}(x)=\sum_{i=32}^{128n-31} bi \bullet x^{i}$$

FIG. 14C

TYPICAL EQUATION
FOR EDC COMPUTATION
ECC (ERROR CORRECTION CODE) :

$$R_{PCA}(x)=\sum_{i=48}^{51} I_{j+4i} \bullet x^{51-i}$$

$$I_{PCA}(x)=\sum_{i=0}^{4n-2} I_{j+4i} \bullet x^{51-i} + D_{j} \bullet x^{52-4n},$$

FIG. 14D

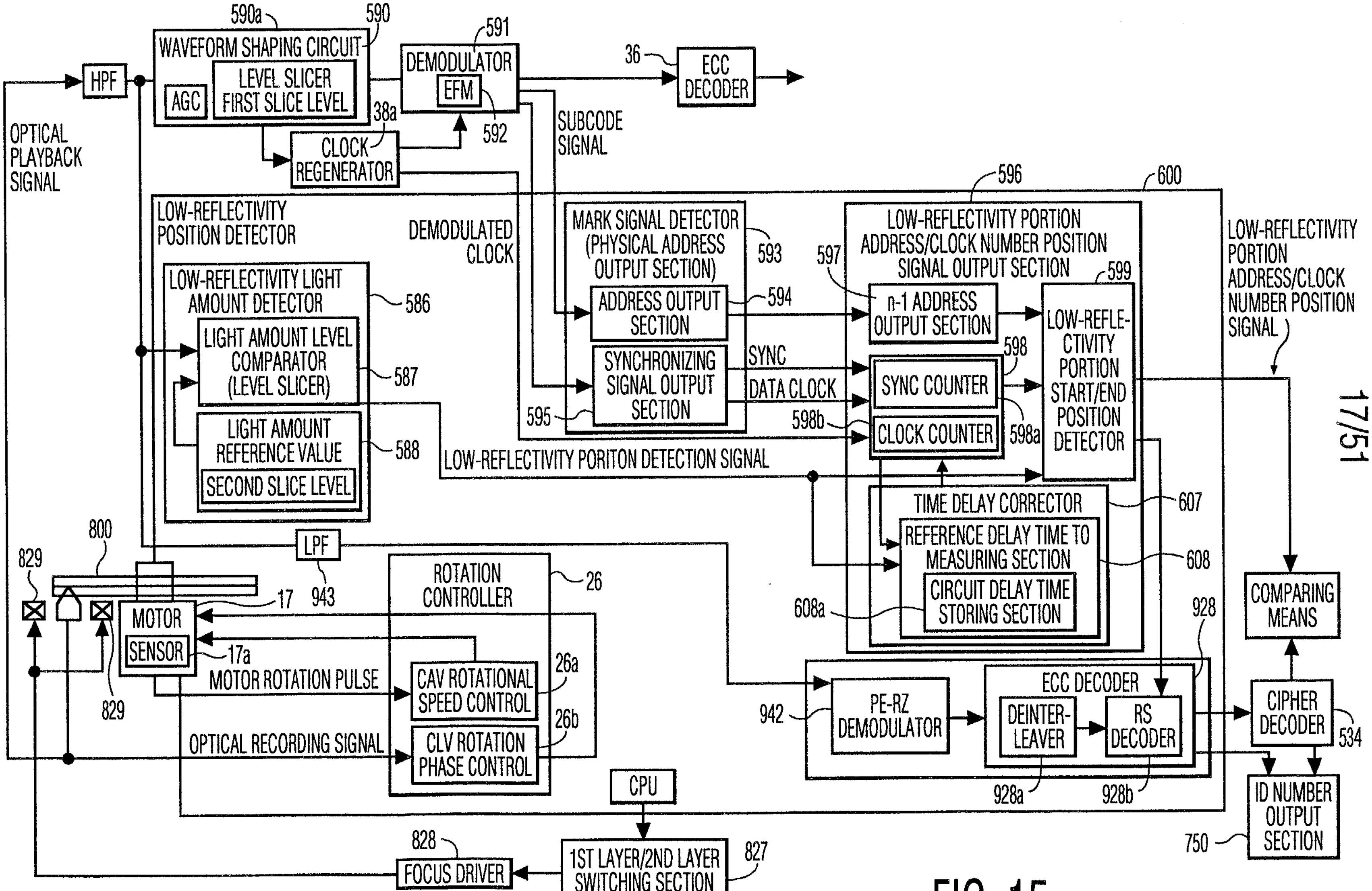

OPTICAL PLAYBACK SIGNAL
HPF
590a
590
WAVEFORM SHAPING CIRCUIT
AGC
LEVEL SLICER
FIRST SLICE LEVEL
38a
CLOCK REGENERATOR
591
DEMODULATOR
EFM
592
36
ECC DECODER
SUBCODE SIGNAL
LOW-REFLECTIVITY POSITION DETECTOR
DEMODULATED CLOCK
LOW-REFLECTIVITY LIGHT AMOUNT DETECTOR
586
LIGHT AMOUNT LEVEL COMPARATOR (LEVEL SLICER)
587
LIGHT AMOUNT REFERENCE VALUE
SECOND SLICE LEVEL
588
MARK SIGNAL DETECTOR (PHYSICAL ADDRESS OUTPUT SECTION)
593
ADDRESS OUTPUT SECTION
594
SYNCHRONIZING SIGNAL OUTPUT SECTION
595
SYNC
DATA CLOCK
LOW-REFLECTIVITY PORITON DETECTION SIGNAL
596
600
LOW-REFLECTIVITY PORTION ADDRESS/CLOCK NUMBER POSITION SIGNAL OUTPUT SECTION
597
n-1 ADDRESS OUTPUT SECTION
598
SYNC COUNTER
598a
598b
CLOCK COUNTER
599
LOW-REFLE-CTIVITY PORTION START/END POSITION DETECTOR
TIME DELAY CORRECTOR
607
REFERENCE DELAY TIME TO MEASURING SECTION
608
CIRCUIT DELAY TIME STORING SECTION
608a
LOW-REFLECTIVITY PORTION ADDRESS/CLOCK NUMBER POSITION SIGNAL
COMPARING MEANS
800
829
17
MOTOR
SENSOR
17a
829
LPF
943
ROTATION CONTROLLER
26
CAV ROTATIONAL SPEED CONTROL
26a
CLV ROTATION PHASE CONTROL
26b
MOTOR ROTATION PULSE
OPTICAL RECORDING SIGNAL
928
942
PE-RZ DEMODULATOR
ECC DECODER
DEINTER-LEAVER
RS DECODER
928a
928b
CIPHER DECODER
534
ID NUMBER OUTPUT SECTION
750
CPU
828
FOCUS DRIVER
1ST LAYER/2ND LAYER SWITCHING SECTION
827

FIG. 15

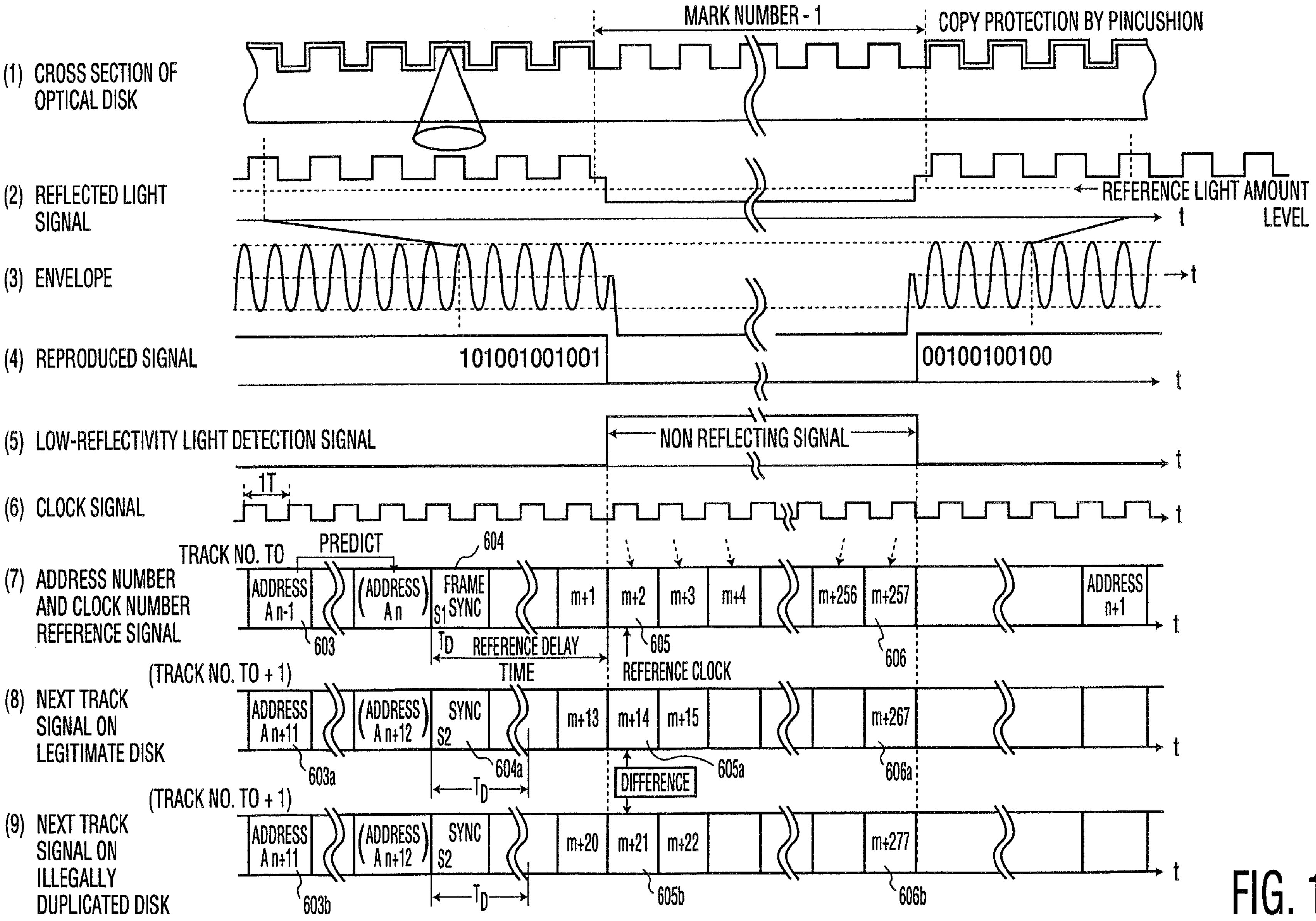

MARK NUMBER - 1
COPY PROTECTION BY PINCUSHION
(1) CROSS SECTION OF OPTICAL DISK
(2) REFLECTED LIGHT SIGNAL
REFERENCE LIGHT AMOUNT LEVEL
t
(3) ENVELOPE
t
(4) REPRODUCED SIGNAL
101001001001
00100100100
t
(5) LOW-REFLECTIVITY LIGHT DETECTION SIGNAL
NON REFLECTING SIGNAL
t
(6) CLOCK SIGNAL
1T
t
TRACK NO. TO
PREDICT
604
(7) ADDRESS NUMBER AND CLOCK NUMBER REFERENCE SIGNAL
ADDRESS A n-1
(ADDRESS A n)
S1 FRAME SYNC
m+1
m+2
m+3
m+4
m+256
m+257
ADDRESS n+1
t
603
TD REFERENCE DELAY TIME
605
REFERENCE CLOCK
606
(TRACK NO. TO + 1)
(8) NEXT TRACK SIGNAL ON LEGITIMATE DISK
ADDRESS A n+11
(ADDRESS A n+12)
SYNC S2
m+13
m+14
m+15
m+267
t
603a
604a
TD
605a
606a
DIFFERENCE
(TRACK NO. TO + 1)
(9) NEXT TRACK SIGNAL ON ILLEGALLY DUPLICATED DISK
ADDRESS A n+11
(ADDRESS A n+12)
SYNC S2
m+20
m+21
m+22
m+277
t
603b
TD
605b
606b

FIG. 16

LEGITIMATE DISK

LOW-REFLECTIVITY PORTION ADDRESS TABLE

609

MARK NO.	START POSITION			END POSITION		
	ADDRESS	SYNC NO	CLOCK NUMBER	ADDRESS	SYNC NO	CLOCK NUMBER
1	A n	S1	m+2	n		m+257
1	A n+12	S2	m+14	n+12		m+267
1	A n+23		m+25	n+23		m+300
:	:		:	:		:
2	A n+1		m+15	n+1		m+160
2	A n+13		m+85	n+13		m+250
2	A n+24		m+68	n+24		m+210
0	A n+9					
0						

PLANNING

ILLEGALLY DUPLICATED DISK

LOW-REFLECTIVITY PORTION ADDRESS TABLE

MARK NO.	START POSITION			END POSITION		
	ADDRESS	SYNC NO	CLOCK NUMBER	ADDRESS	SYNC NO	CLOCK NUMBER
1	n	S1	m+2	n		m+257
1	n+12	S2	m+21	n+12		m+277
1	n+22		m+4	n+22		m+230
:	:		:	:		:
2	n+1		m+36	n+1		m+190
2	n+13		m+120	n+13		m+281
2	n+25			n+25		
0	n+9					
0						

FIG. 17

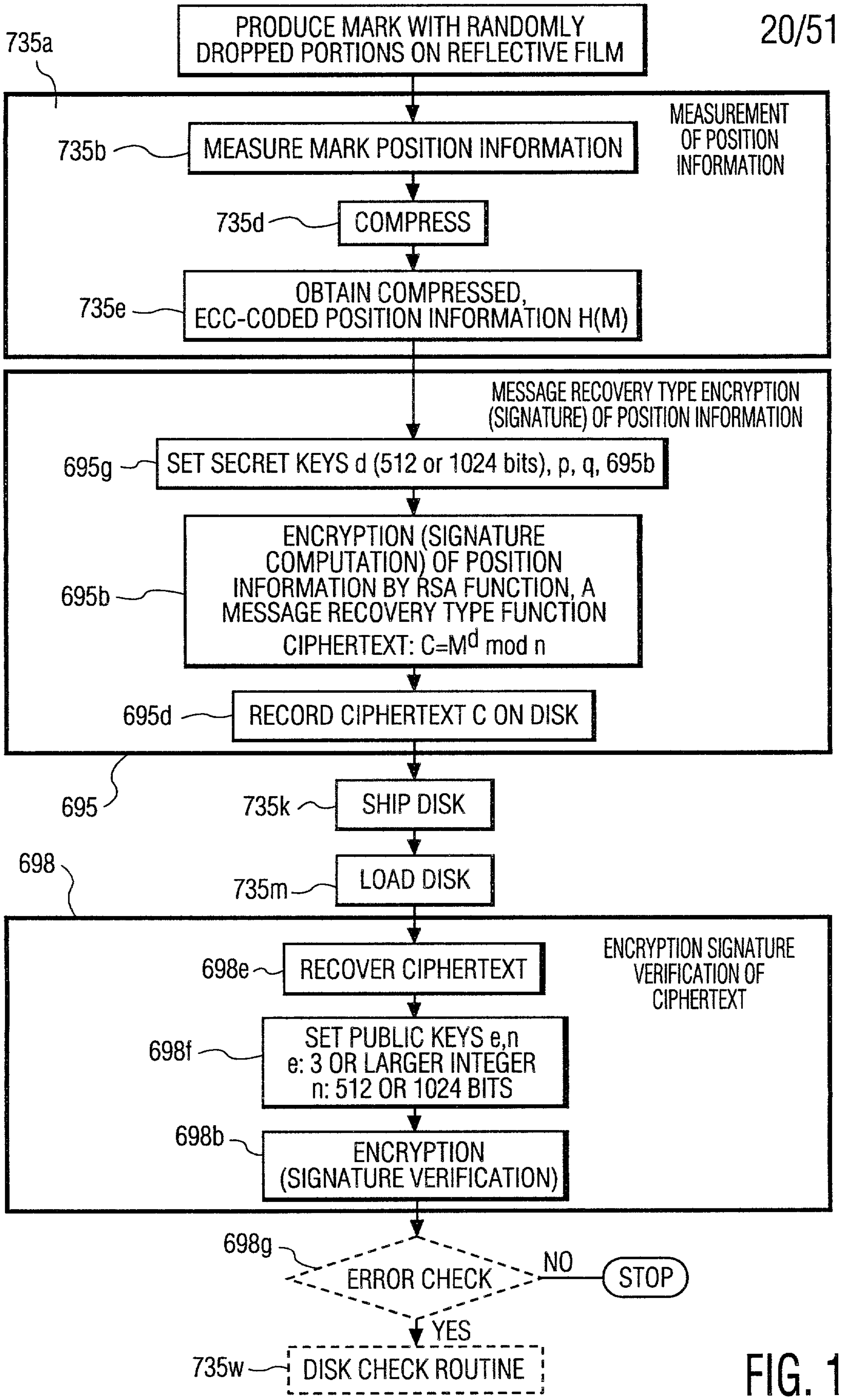

PRODUCE MARK WITH RANDOMLY DROPPED PORTIONS ON REFLECTIVE FILM
735a
MEASUREMENT OF POSITION INFORMATION
735b
MEASURE MARK POSITION INFORMATION
735d
COMPRESS
735e
OBTAIN COMPRESSED, ECC-CODED POSITION INFORMATION H(M)
MESSAGE RECOVERY TYPE ENCRYPTION (SIGNATURE) OF POSITION INFORMATION
695g
SET SECRET KEYS d (512 or 1024 bits), p, q, 695b
695b
ENCRYPTION (SIGNATURE COMPUTATION) OF POSITION INFORMATION BY RSA FUNCTION, A MESSAGE RECOVERY TYPE FUNCTION
CIPHERTEXT: C=M^d mod n
695d
RECORD CIPHERTEXT C ON DISK
695
735k
SHIP DISK
698
735m
LOAD DISK
ENCRYPTION SIGNATURE VERIFICATION OF CIPHERTEXT
698e
RECOVER CIPHERTEXT
698f
SET PUBLIC KEYS e,n
e: 3 OR LARGER INTEGER
n: 512 OR 1024 BITS
698b
ENCRYPTION (SIGNATURE VERIFICATION)
698g
ERROR CHECK
NO
STOP
YES
735w
DISK CHECK ROUTINE

FIG. 18A

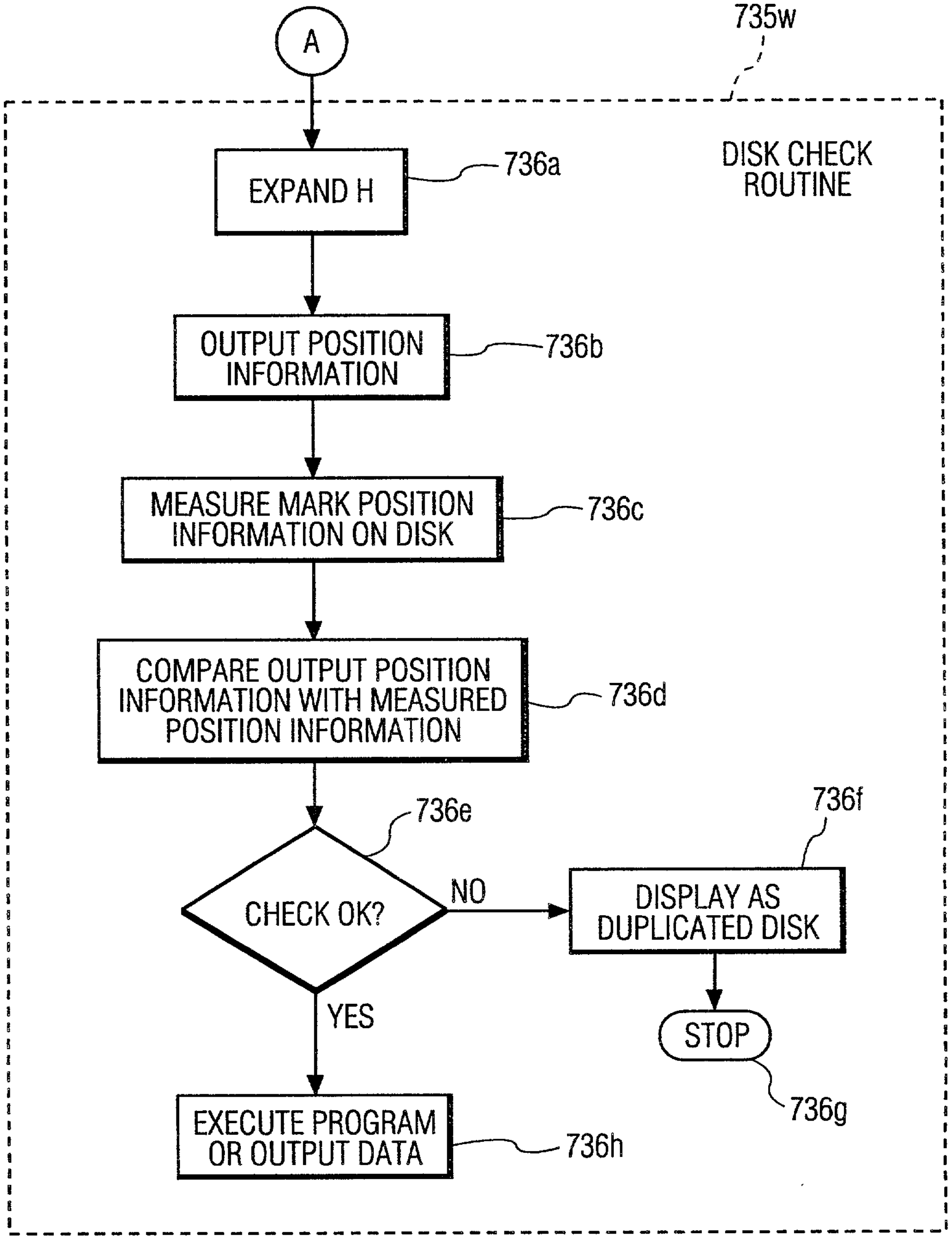

A
735w
DISK CHECK ROUTINE
EXPAND H
736a
OUTPUT POSITION INFORMATION
736b
MEASURE MARK POSITION INFORMATION ON DISK
736c
COMPARE OUTPUT POSITION INFORMATION WITH MEASURED POSITION INFORMATION
736d
736e
CHECK OK?
NO
736f
DISPLAY AS DUPLICATED DISK
YES
STOP
736g
EXECUTE PROGRAM OR OUTPUT DATA
736h

FIG. 18B

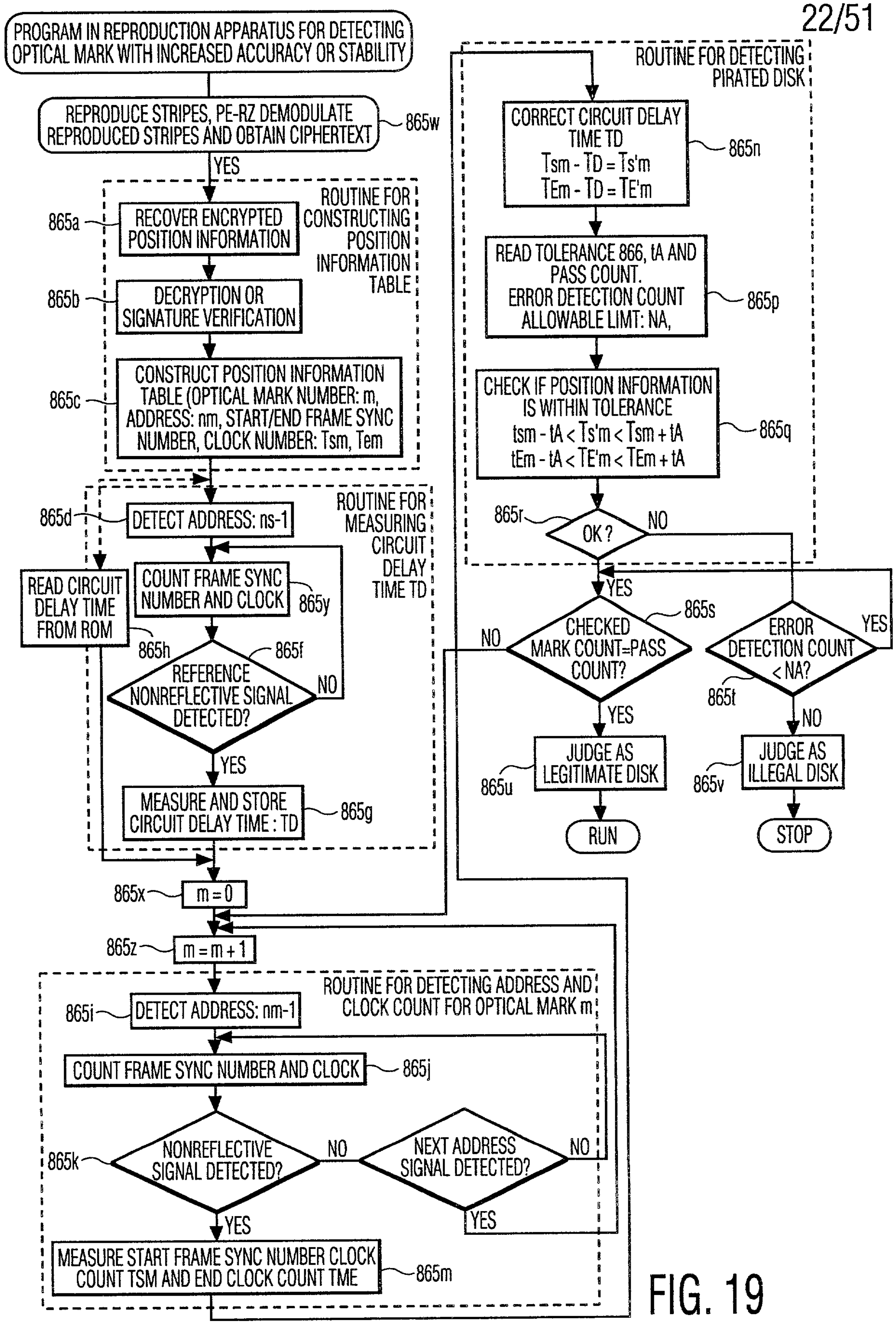

PROGRAM IN REPRODUCTION APPARATUS FOR DETECTING OPTICAL MARK WITH INCREASED ACCURACY OR STABILITY
REPRODUCE STRIPES, PE-RZ DEMODULATE REPRODUCED STRIPES AND OBTAIN CIPHERTEXT
865w
YES
ROUTINE FOR CONSTRUCTING POSITION INFORMATION TABLE
865a
RECOVER ENCRYPTED POSITION INFORMATION
865b
DECRYPTION OR SIGNATURE VERIFICATION
865c
CONSTRUCT POSITION INFORMATION TABLE (OPTICAL MARK NUMBER: m, ADDRESS: nm, START/END FRAME SYNC NUMBER, CLOCK NUMBER: Tsm, Tem
ROUTINE FOR MEASURING CIRCUIT DELAY TIME TD
865d
DETECT ADDRESS: ns-1
COUNT FRAME SYNC NUMBER AND CLOCK
865y
READ CIRCUIT DELAY TIME FROM ROM
865h
865f
REFERENCE NONREFLECTIVE SIGNAL DETECTED?
NO
YES
MEASURE AND STORE CIRCUIT DELAY TIME : TD
865g
865x
m = 0
865z
m = m + 1
ROUTINE FOR DETECTING ADDRESS AND CLOCK COUNT FOR OPTICAL MARK m
865i
DETECT ADDRESS: nm-1
COUNT FRAME SYNC NUMBER AND CLOCK
865j
865k
NONREFLECTIVE SIGNAL DETECTED?
NO
NEXT ADDRESS SIGNAL DETECTED?
NO
YES
YES
MEASURE START FRAME SYNC NUMBER CLOCK COUNT TSM AND END CLOCK COUNT TME
865m
ROUTINE FOR DETECTING PIRATED DISK
CORRECT CIRCUIT DELAY TIME TD
Tsm - TD = Ts'm
TEm - TD = TE'm
865n
READ TOLERANCE 866, tA AND PASS COUNT.
ERROR DETECTION COUNT ALLOWABLE LIMT: NA,
865p
CHECK IF POSITION INFORMATION IS WITHIN TOLERANCE
tsm - tA < Ts'm < Tsm + tA
tEm - tA < TE'm < TEm + tA
865q
865r
OK ?
NO
YES
NO
CHECKED MARK COUNT=PASS COUNT?
865s
ERROR DETECTION COUNT < NA?
YES
865t
YES
NO
JUDGE AS LEGITIMATE DISK
865u
JUDGE AS ILLEGAL DISK
865v
RUN
STOP

FIG. 19

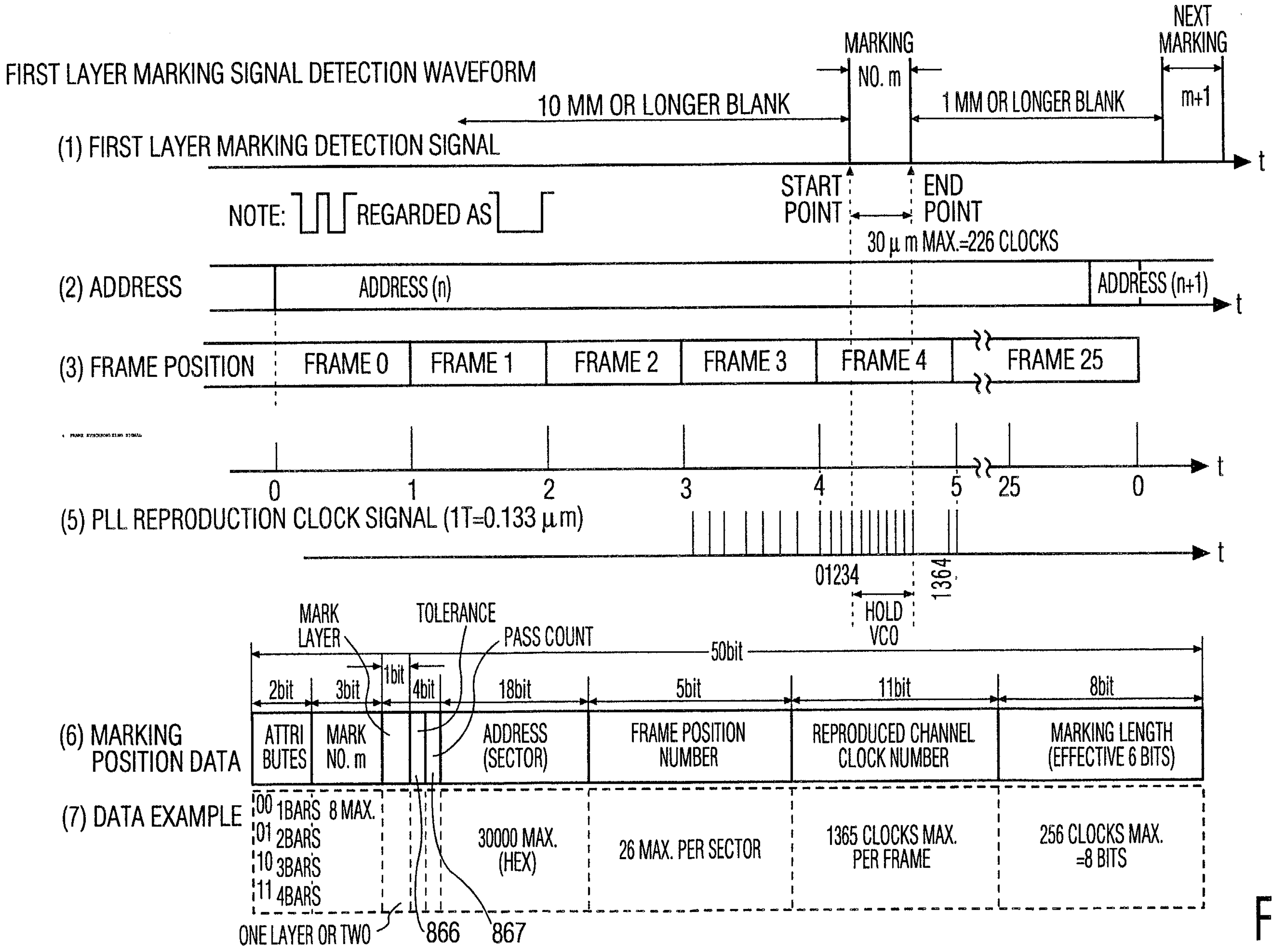

FIRST LAYER MARKING SIGNAL DETECTION WAVEFORM
MARKING
NO. m
NEXT MARKING
m+1
10 MM OR LONGER BLANK
1 MM OR LONGER BLANK
(1) FIRST LAYER MARKING DETECTION SIGNAL
t
START POINT
END POINT
NOTE: REGARDED AS
30 μ m MAX.=226 CLOCKS
(2) ADDRESS
ADDRESS (n)
ADDRESS (n+1)
(3) FRAME POSITION
FRAME 0
FRAME 1
FRAME 2
FRAME 3
FRAME 4
FRAME 25
0
1
2
3
4
5
25
0
(5) PLL REPRODUCTION CLOCK SIGNAL (1T=0.133 μm)
01234
1364
HOLD VCO
MARK LAYER
TOLERANCE
PASS COUNT
50bit
2bit
3bit
1bit
4bit
18bit
5bit
11bit
8bit
(6) MARKING POSITION DATA
ATTRI BUTES
MARK NO. m
ADDRESS (SECTOR)
FRAME POSITION NUMBER
REPRODUCED CHANNEL CLOCK NUMBER
MARKING LENGTH (EFFECTIVE 6 BITS)
(7) DATA EXAMPLE
00 1BARS
01 2BARS
10 3BARS
11 4BARS
8 MAX.
30000 MAX. (HEX)
26 MAX. PER SECTOR
1365 CLOCKS MAX. PER FRAME
256 CLOCKS MAX. =8 BITS
ONE LAYER OR TWO
866
867

FIG. 20

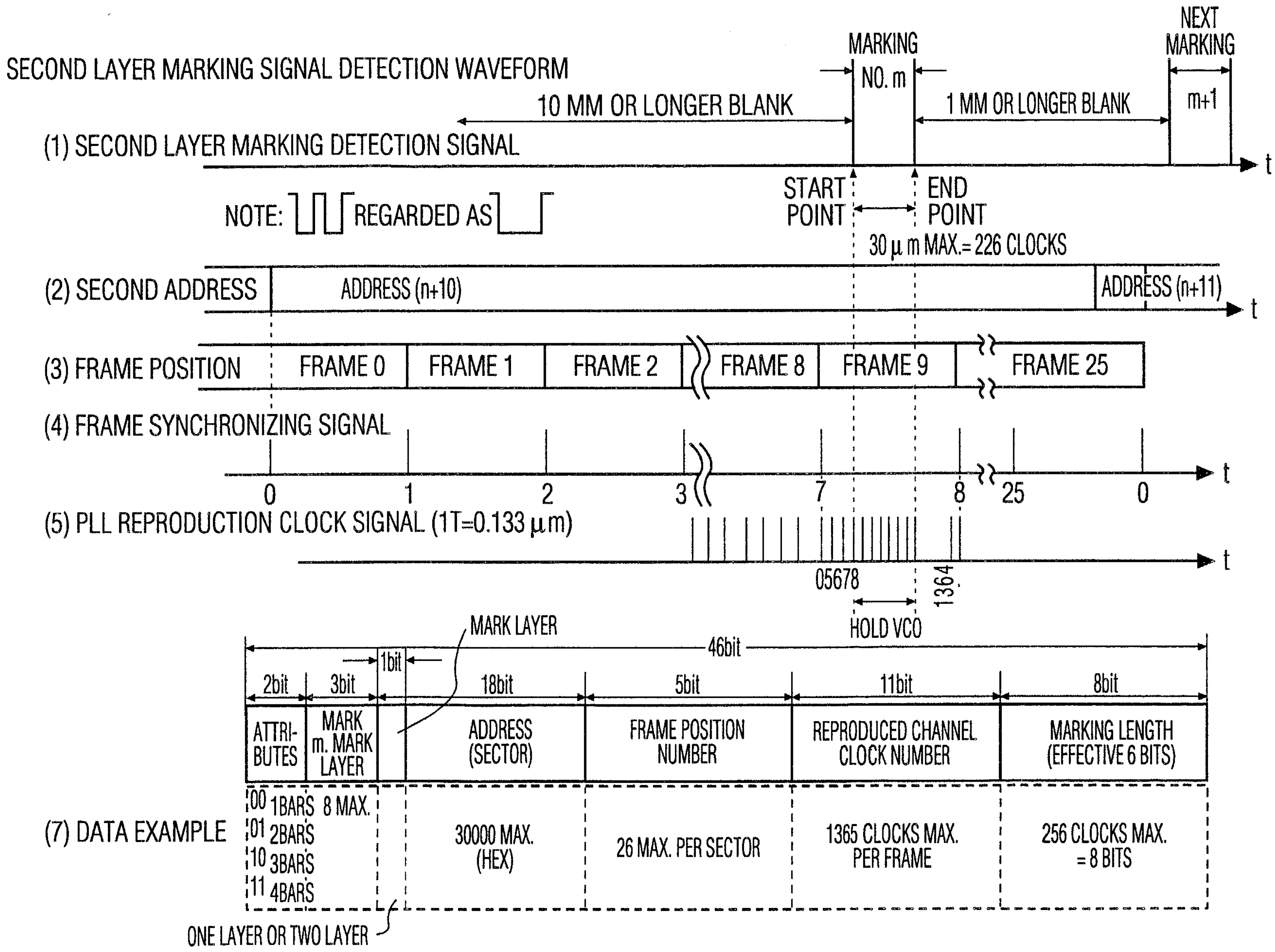

SECOND LAYER MARKING SIGNAL DETECTION WAVEFORM
MARKING
NO. m
NEXT MARKING
m+1
10 MM OR LONGER BLANK
1 MM OR LONGER BLANK
(1) SECOND LAYER MARKING DETECTION SIGNAL
t
NOTE:
REGARDED AS
START POINT
END POINT
30 μ m MAX.= 226 CLOCKS
(2) SECOND ADDRESS
ADDRESS (n+10)
ADDRESS (n+11)
t
(3) FRAME POSITION
FRAME 0
FRAME 1
FRAME 2
FRAME 8
FRAME 9
FRAME 25
(4) FRAME SYNCHRONIZING SIGNAL
0
1
2
3
7
8
25
0
t
(5) PLL REPRODUCTION CLOCK SIGNAL (1T=0.133 μm)
t
05678
1364
HOLD VCO
MARK LAYER
46bit
1bit
2bit
3bit
18bit
5bit
11bit
8bit
ATTRI-BUTES
MARK m. MARK LAYER
ADDRESS (SECTOR)
FRAME POSITION NUMBER
REPRODUCED CHANNEL CLOCK NUMBER
MARKING LENGTH (EFFECTIVE 6 BITS)
(7) DATA EXAMPLE
00 1BARS
01 2BARS
10 3BARS
11 4BARS
8 MAX.
30000 MAX. (HEX)
26 MAX. PER SECTOR
1365 CLOCKS MAX. PER FRAME
256 CLOCKS MAX. = 8 BITS
ONE LAYER OR TWO LAYER

FIG. 21

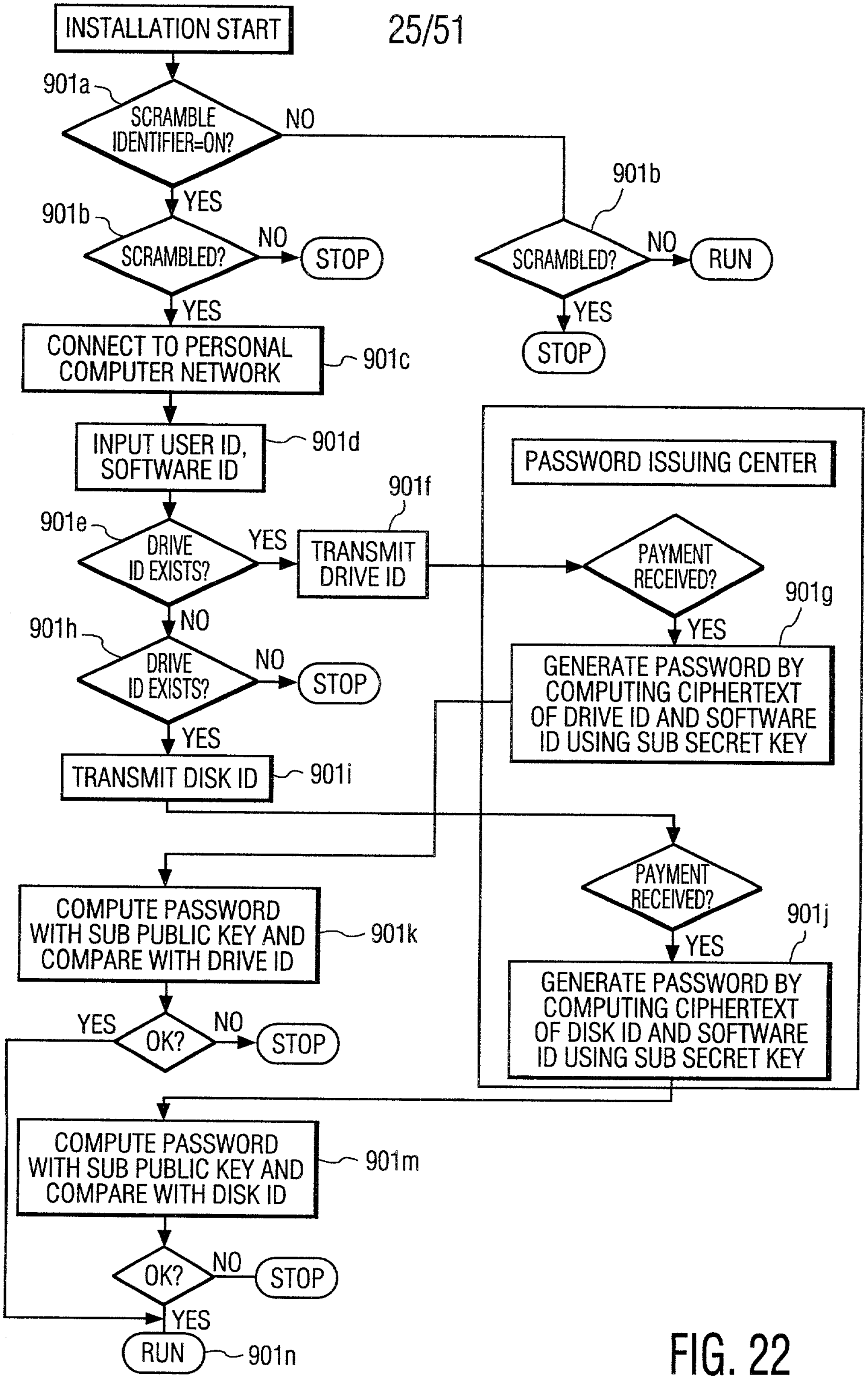

INSTALLATION START
901a
SCRAMBLE IDENTIFIER=ON?
NO
YES
901b
SCRAMBLED?
NO
STOP
YES
CONNECT TO PERSONAL COMPUTER NETWORK
901c
INPUT USER ID, SOFTWARE ID
901d
901e
DRIVE ID EXISTS?
YES
TRANSMIT DRIVE ID
901f
NO
901h
DRIVE ID EXISTS?
NO
STOP
YES
TRANSMIT DISK ID
901i
901b
SCRAMBLED?
NO
RUN
YES
STOP
PASSWORD ISSUING CENTER
PAYMENT RECEIVED?
901g
YES
GENERATE PASSWORD BY COMPUTING CIPHERTEXT OF DRIVE ID AND SOFTWARE ID USING SUB SECRET KEY
PAYMENT RECEIVED?
901j
YES
GENERATE PASSWORD BY COMPUTING CIPHERTEXT OF DISK ID AND SOFTWARE ID USING SUB SECRET KEY
COMPUTE PASSWORD WITH SUB PUBLIC KEY AND COMPARE WITH DRIVE ID
901k
YES
OK?
NO
STOP
COMPUTE PASSWORD WITH SUB PUBLIC KEY AND COMPARE WITH DISK ID
901m
OK?
NO
STOP
YES
RUN
901n

FIG. 22

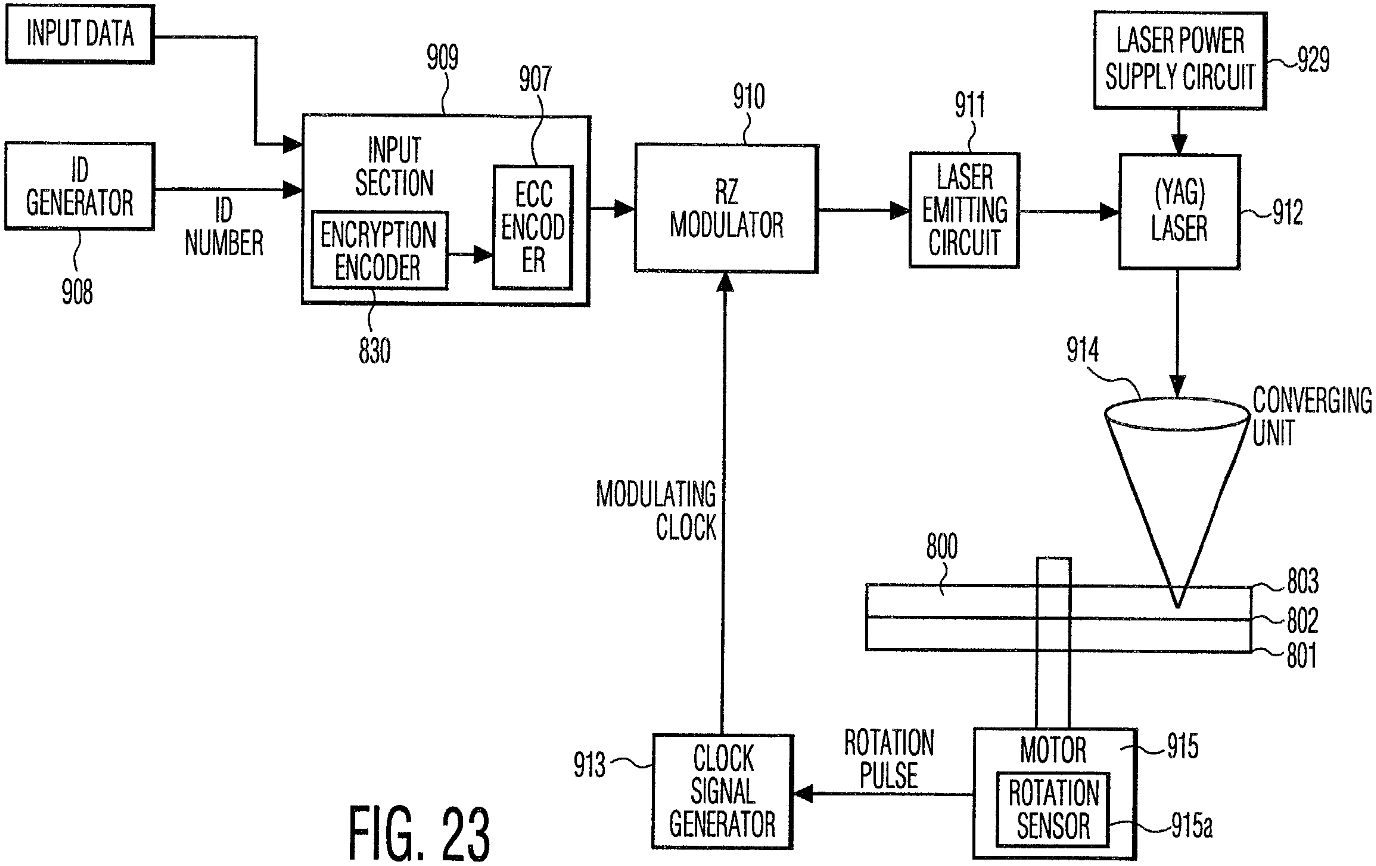

INPUT DATA
ID GENERATOR
908
ID NUMBER
909
INPUT SECTION
907
ECC ENCODER
ENCRYPTION ENCODER
830
910
RZ MODULATOR
911
LASER EMITTING CIRCUIT
LASER POWER SUPPLY CIRCUIT
929
(YAG) LASER
912
914
CONVERGING UNIT
MODULATING CLOCK
800
803
802
801
913
CLOCK SIGNAL GENERATOR
ROTATION PULSE
MOTOR
915
ROTATION SENSOR
915a

FIG. 23

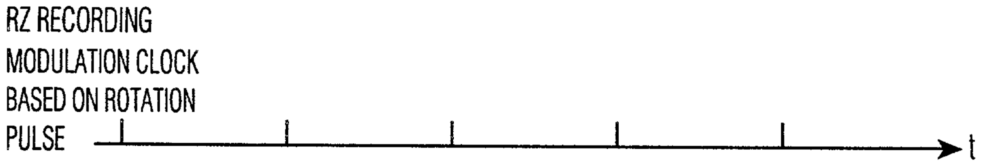


FIG. 24A

(1) RECORDED SIGNAL OF "00"

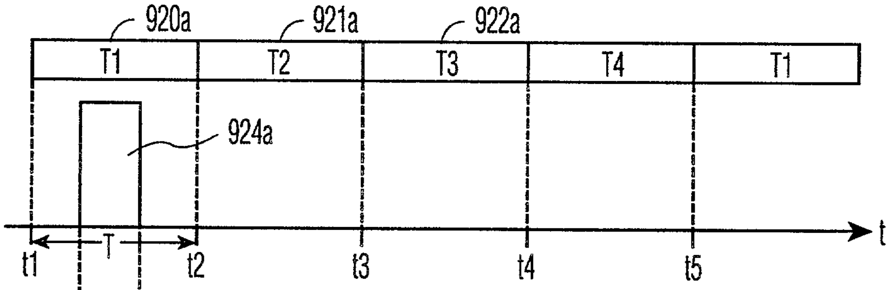


FIG. 24B

(2) TRIMMING PATTERN OF "00"

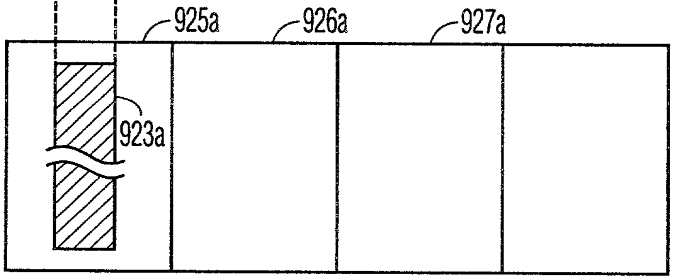


FIG. 24C

(3) RECORDED SIGNAL OF "01"

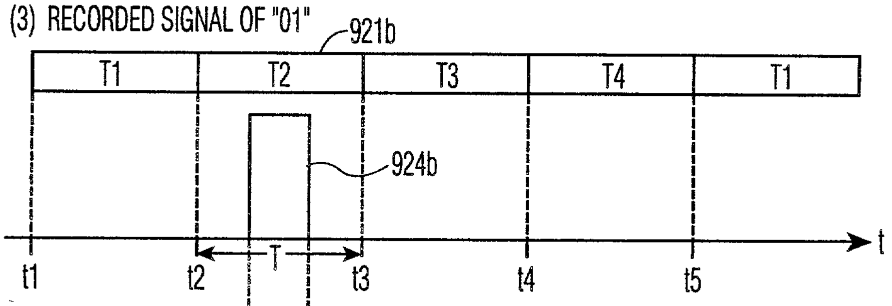


FIG. 24D

(4) TRIMMING PATTERN OF "01"

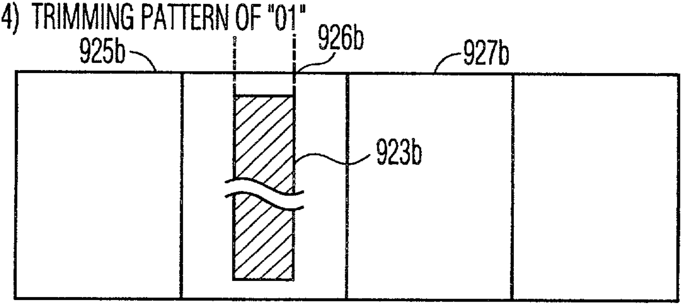


FIG. 24E

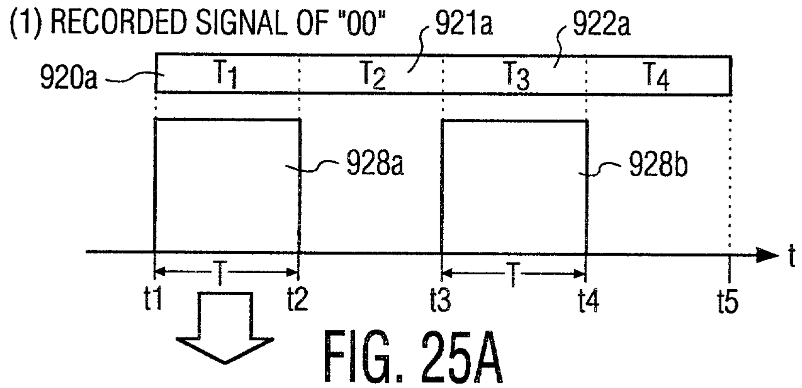


FIG. 25A

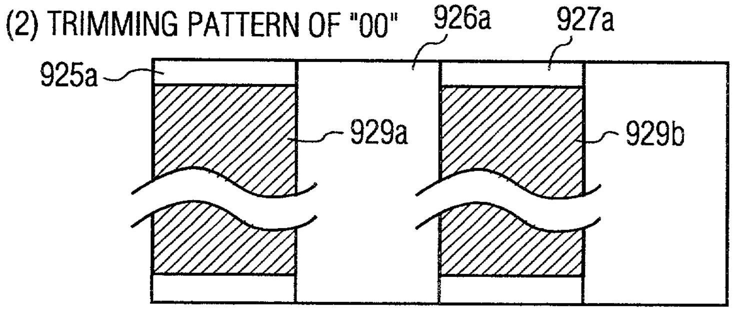


FIG. 25B

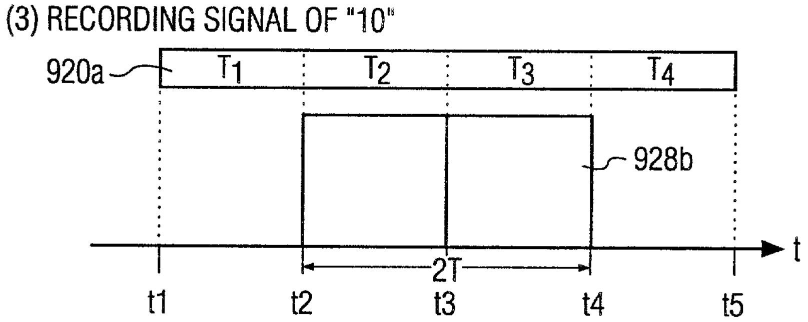


FIG. 25C

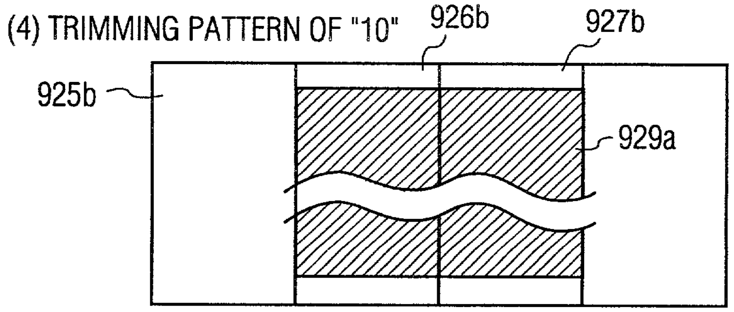


FIG. 25D

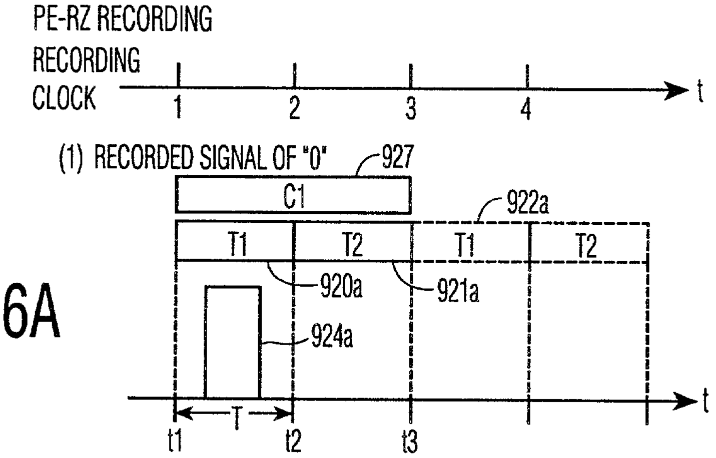


FIG. 26A

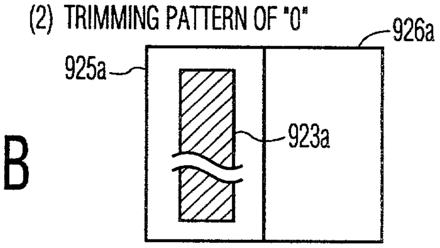


FIG. 26B

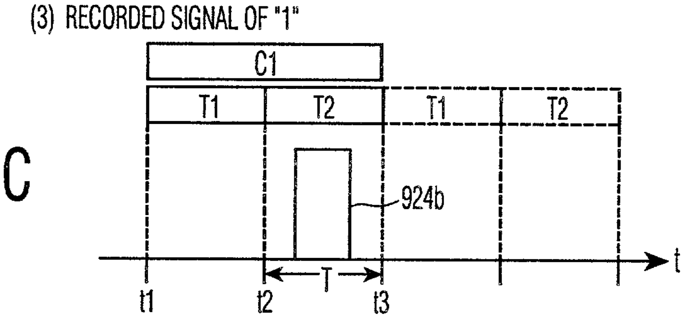


FIG. 26C

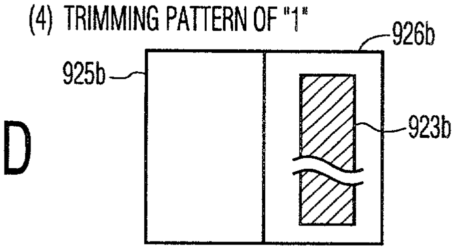


FIG. 26D

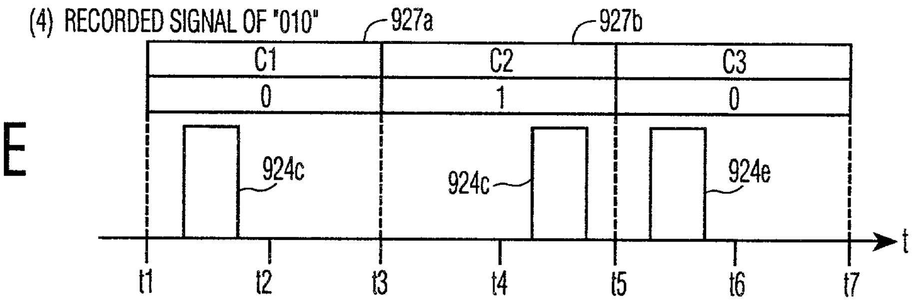


FIG. 26E

(1) TOP PLAN VIEW

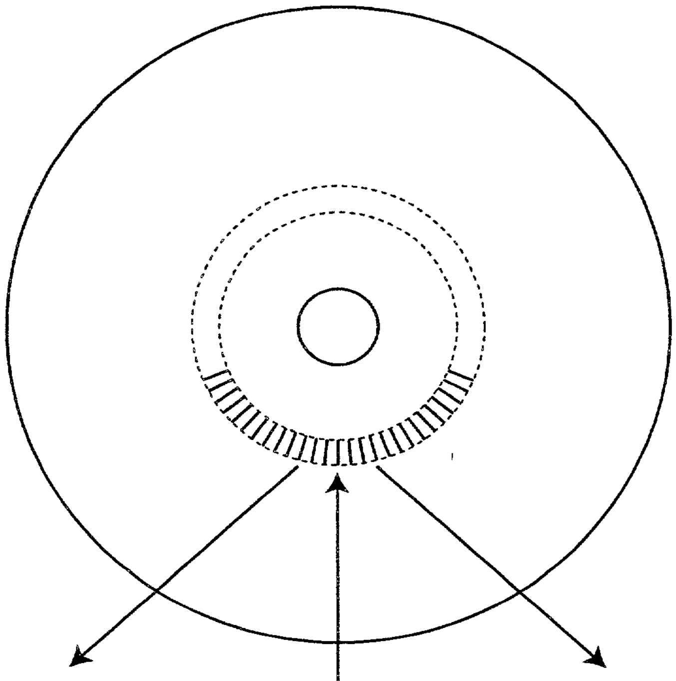


FIG. 27A

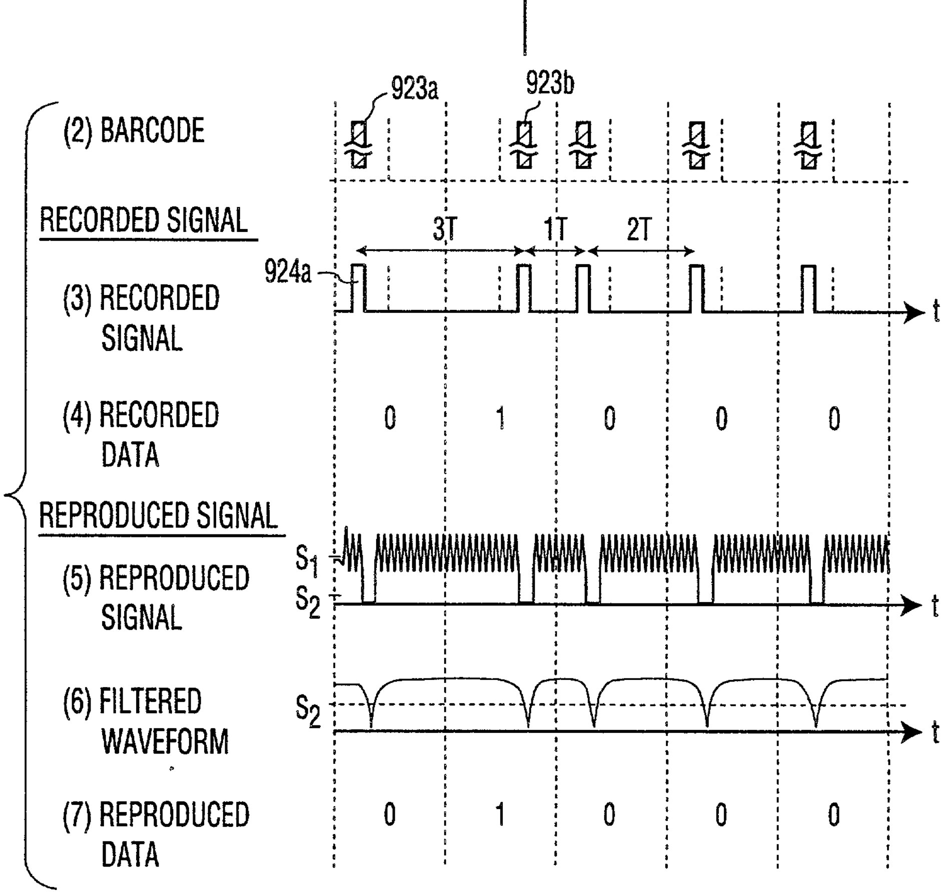


FIG. 27B

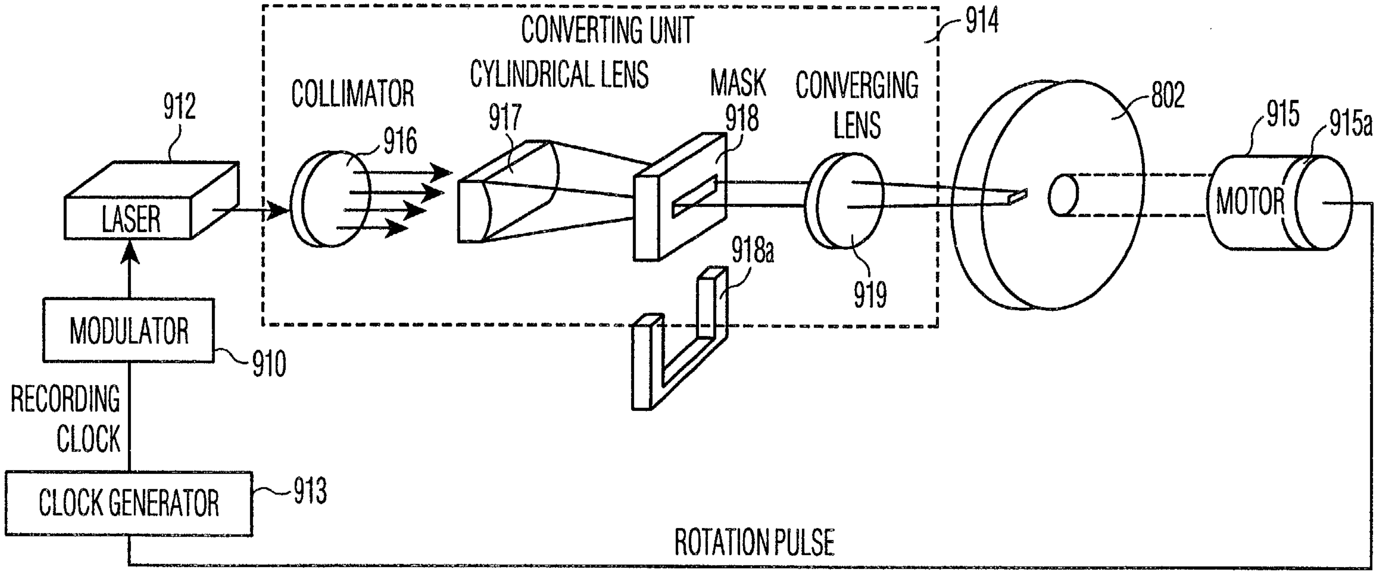


FIG. 28A

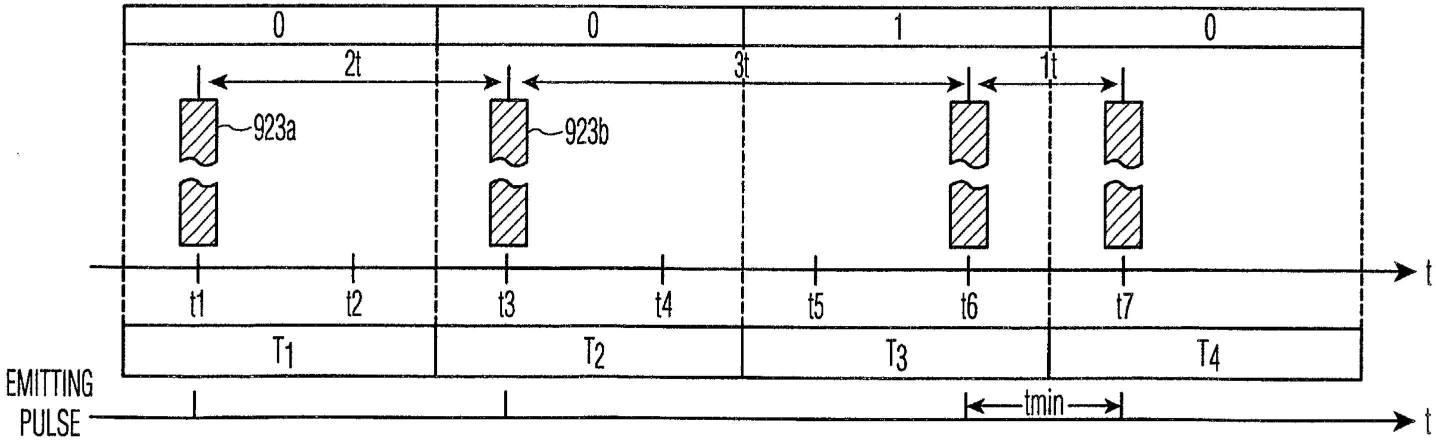


FIG. 28B

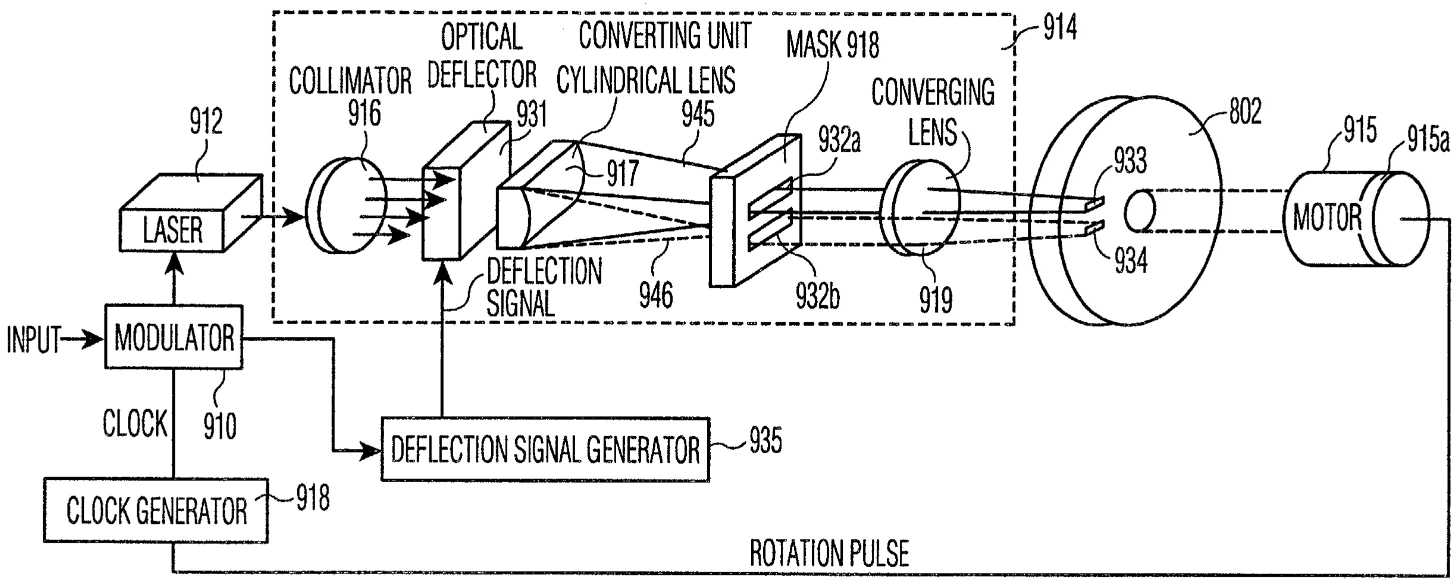


FIG. 29A

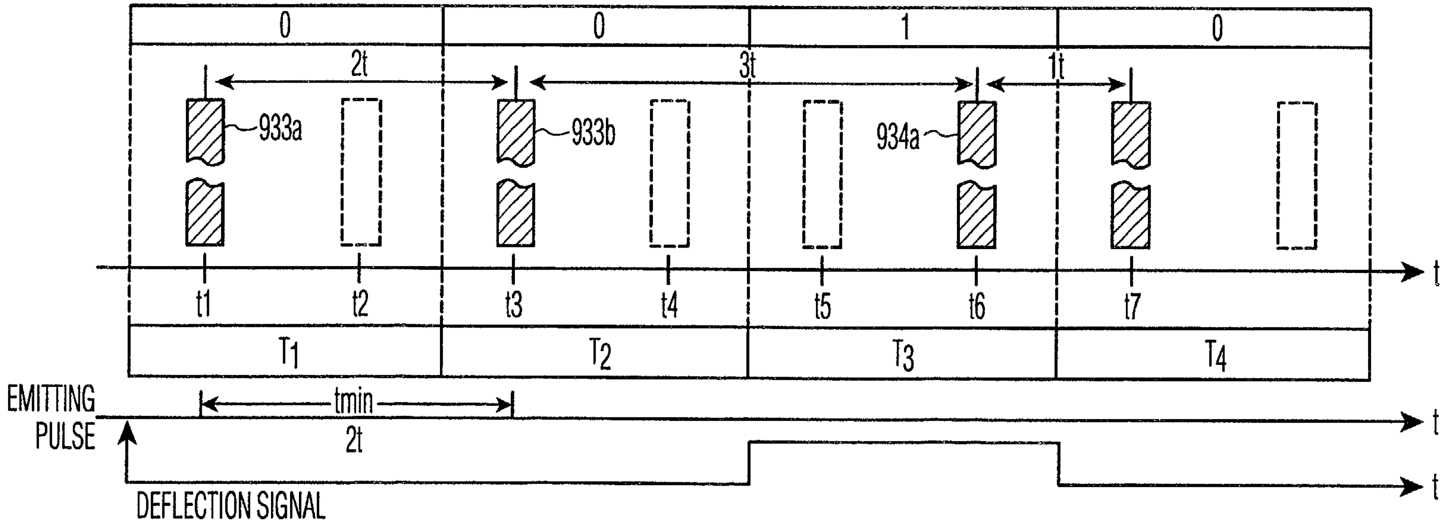


FIG. 29B

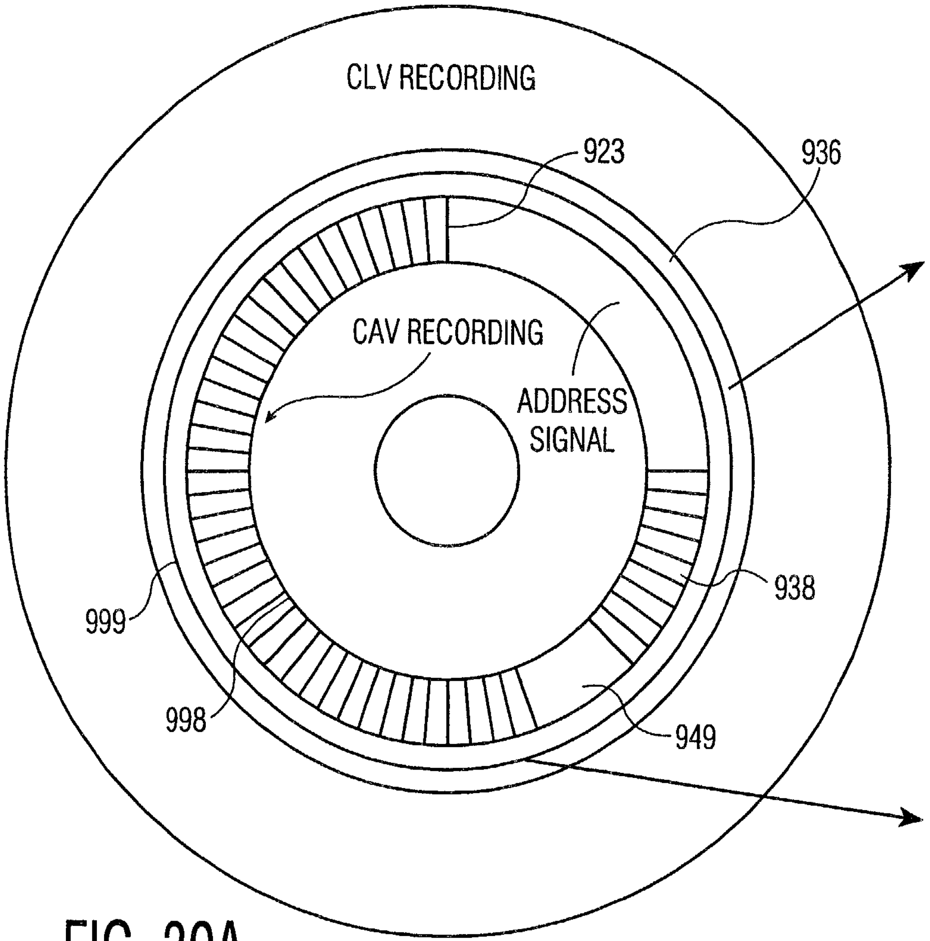
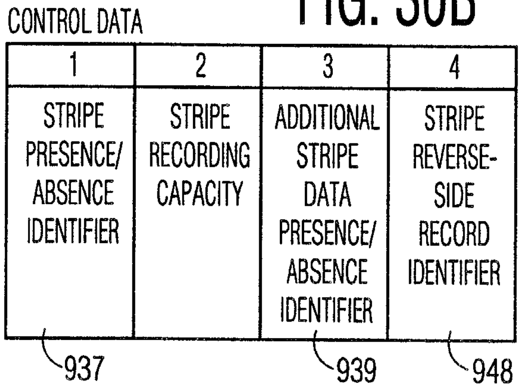


FIG. 30A



CONTROL DATA

1	2	3	4
STRIPE PRESENCE/ ABSENCE IDENTIFIER	STRIPE RECORDING CAPACITY	ADDITIONAL STRIPE DATA PRESENCE/ ABSENCE IDENTIFIER	STRIPE REVERSE-SIDE RECORD IDENTIFIER

FIG. 30B

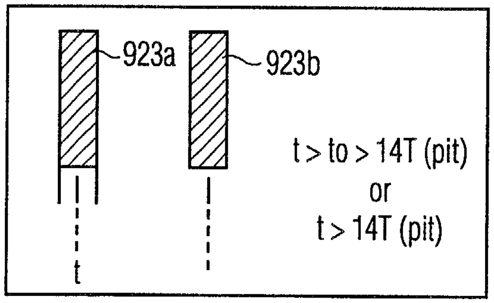


FIG. 30C

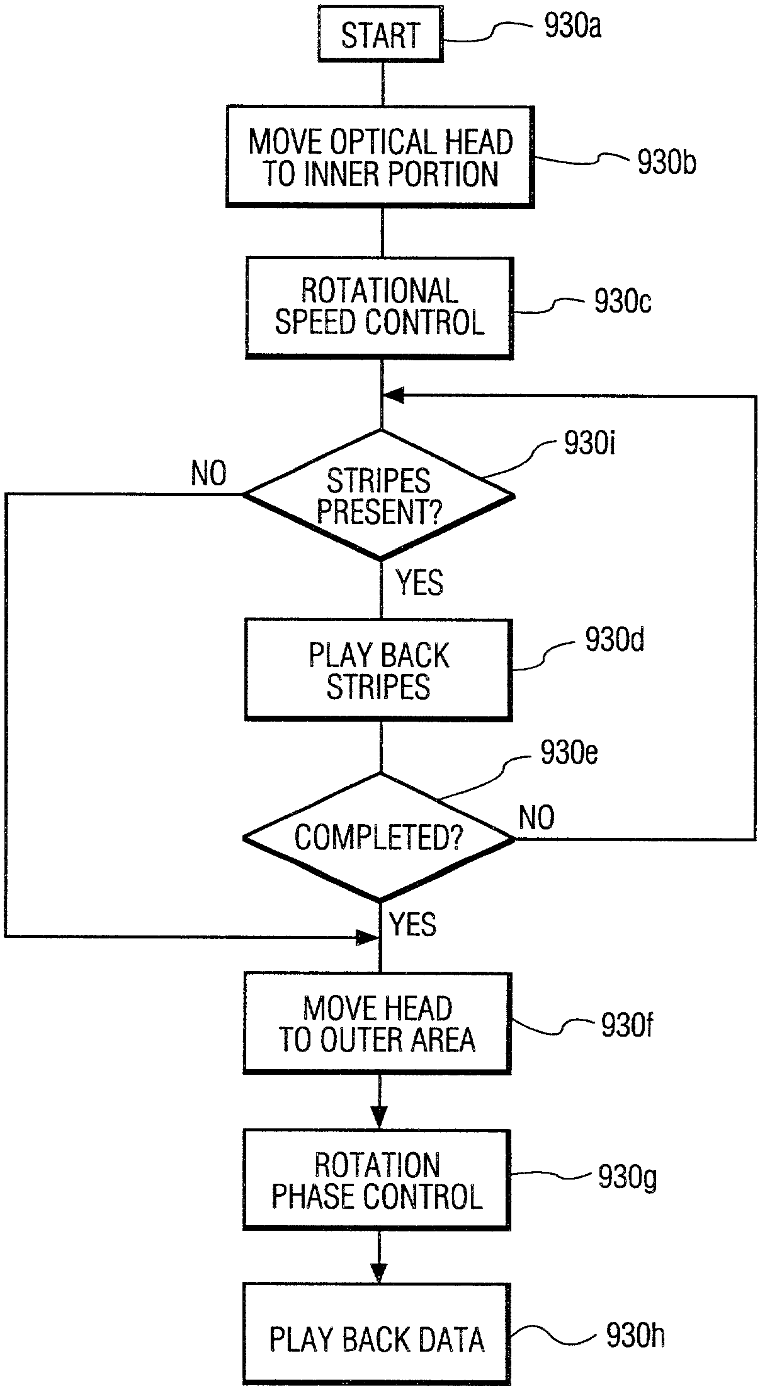

START
930a
MOVE OPTICAL HEAD TO INNER PORTION
930b
ROTATIONAL SPEED CONTROL
930c
STRIPES PRESENT?
930i
NO
YES
PLAY BACK STRIPES
930d
COMPLETED?
930e
NO
YES
MOVE HEAD TO OUTER AREA
930f
ROTATION PHASE CONTROL
930g
PLAY BACK DATA
930h

FIG. 31

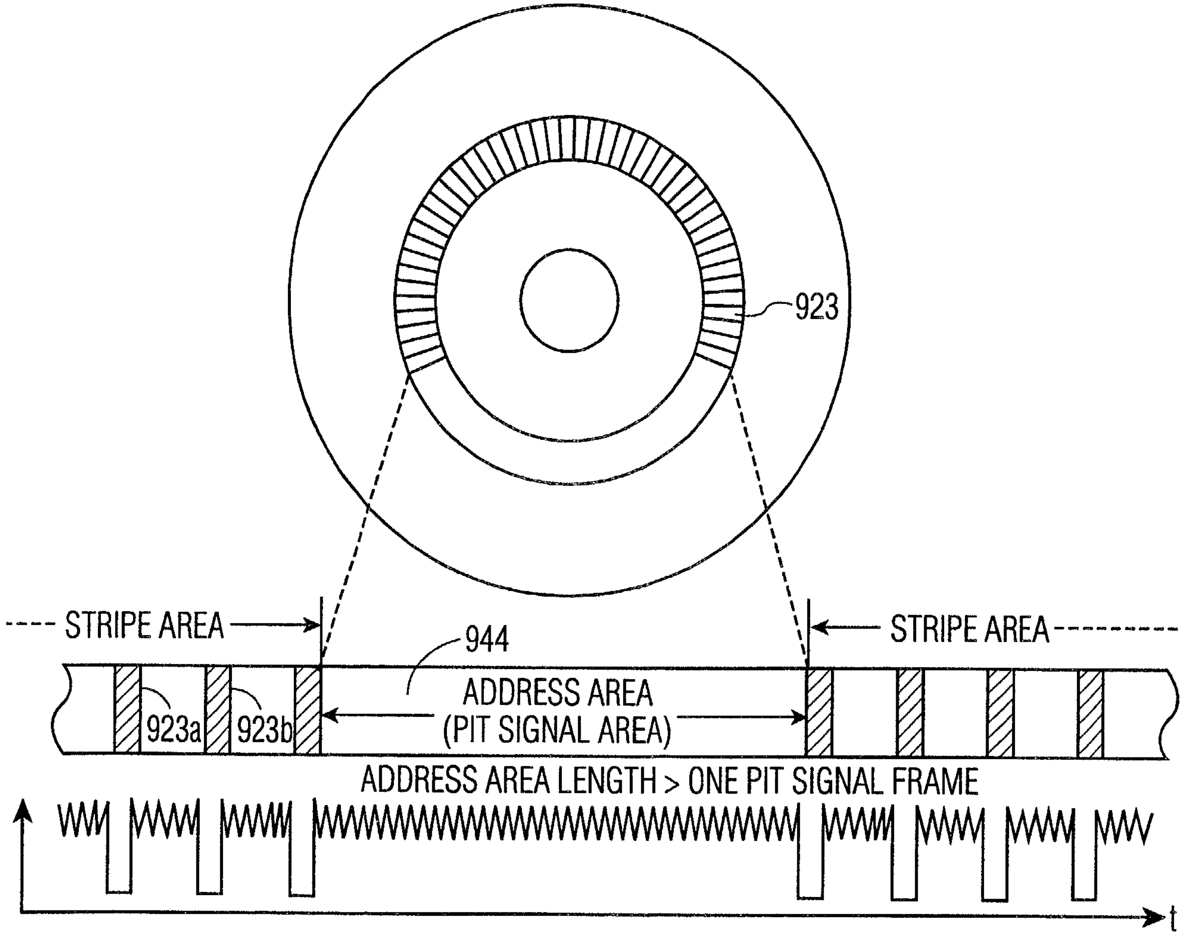

923
STRIPE AREA
944
STRIPE AREA
923a
923b
ADDRESS AREA
(PIT SIGNAL AREA)
ADDRESS AREA LENGTH > ONE PIT SIGNAL FRAME
t

FIG. 32

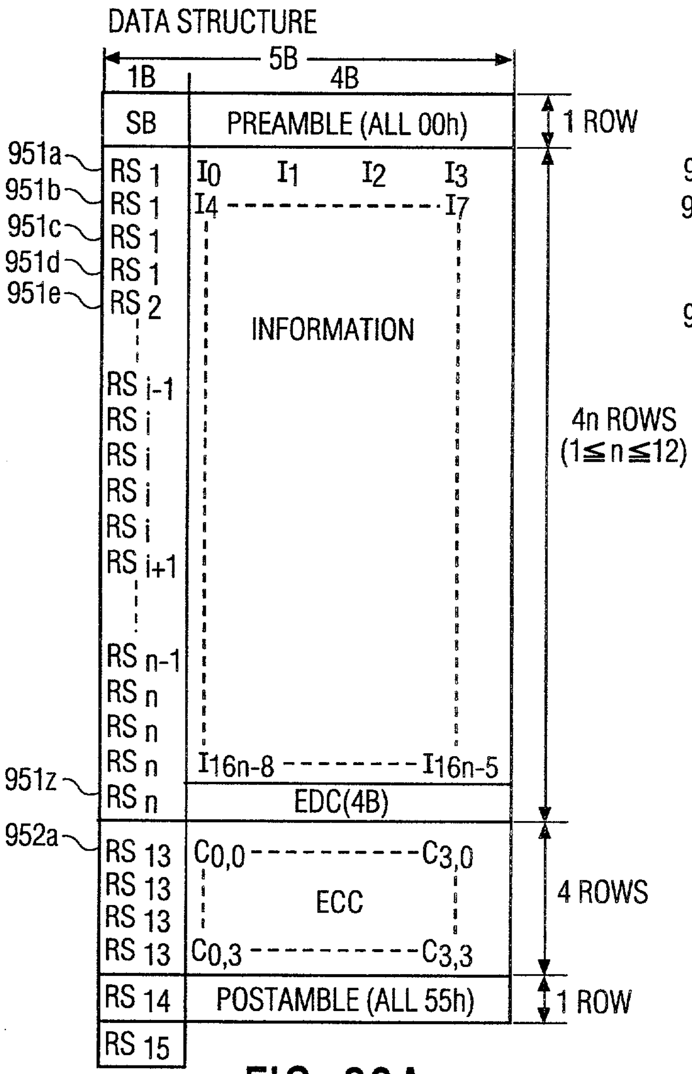


FIG. 33A

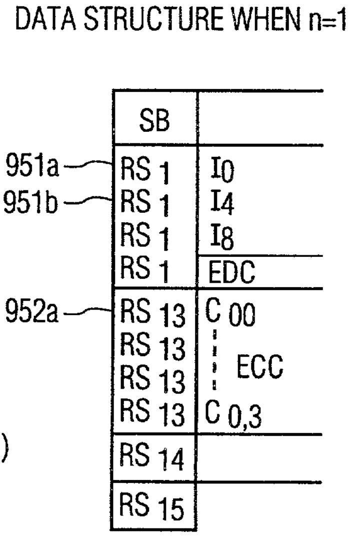


FIG. 33B

RANDOM ERROR CORRECTION CAPABILITY

BIT ERROR RATE BEFORE CORRECTION	READ ERROR RATE AFTER CORRECTION
10^{-5}	1 IN 10^{10} DISKS
10^{-4}	1 IN 10^{7} DISKS
10^{-3}	1 IN 10^{4} DISKS
BURST ERROR CORRECTION CAPABILITY	

FIG. 33C

SYNCHRONIZATION CODE DATA

SYNCHRONIZATION CODE

SYNC BYTE /RESYNC	BIT PATTERN											
	FIXED PATTERN (CHANNEL BIT)								SYNC CODE (DATA BIT)			
	C_{15}	C_{14}	C_{13}	C_{12}	C_{11}	C_{10}	C_9	C_8	b_3	b_2	b_1	b_0
SB	0	1	0	0	0	1	1	0	0	0	0	0
RS_1	0	1	0	0	0	1	1	0	0	0	0	1
RS_2	0	1	0	0	0	1	1	0	0	0	1	0
⋮				⋮						⋮		
RS_i	0	1	0	0	0	1	1	0		i		
⋮				⋮						⋮		
RS_{15}	0	1	0	0	0	1	1	0	1	1	1	1

FIG. 34A

FIXED SYNCHRONIZATION PATTERN

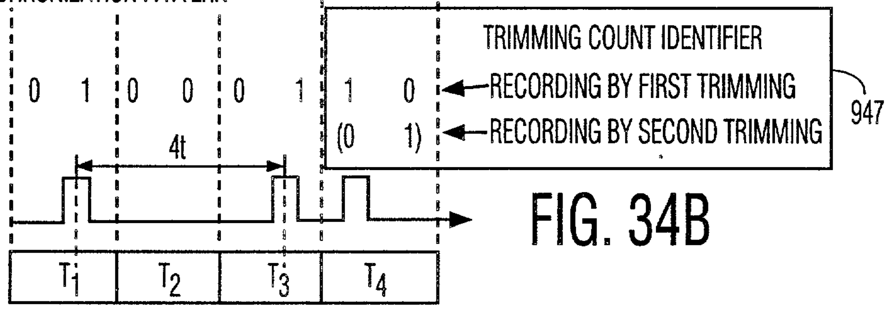


FIG. 34B

MAXIMUM CAPACITY

	RECORDING CAPACITY	TOTAL BYTE COUNT	EFFICIENCY	RECORDING AREA ANGLE	UNRECORDED AREA ANGLE
MINIMUM	12B	41B	29.3%	51 DEGREES	309 DEGREES
MAXIMUM	188B	271B	69.4%	336 DEGREES	24 DEGREES

FIG. 34C

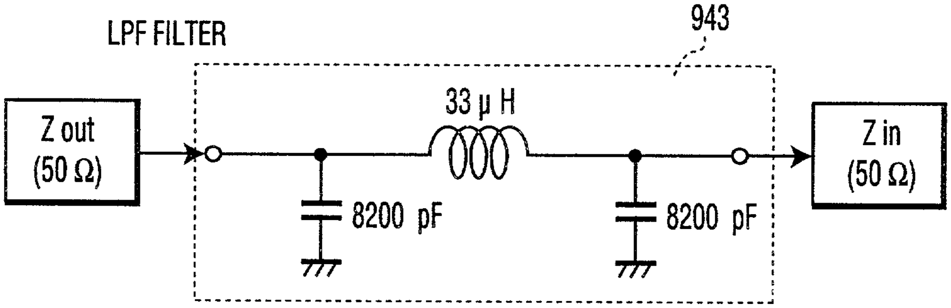


FIG. 35A

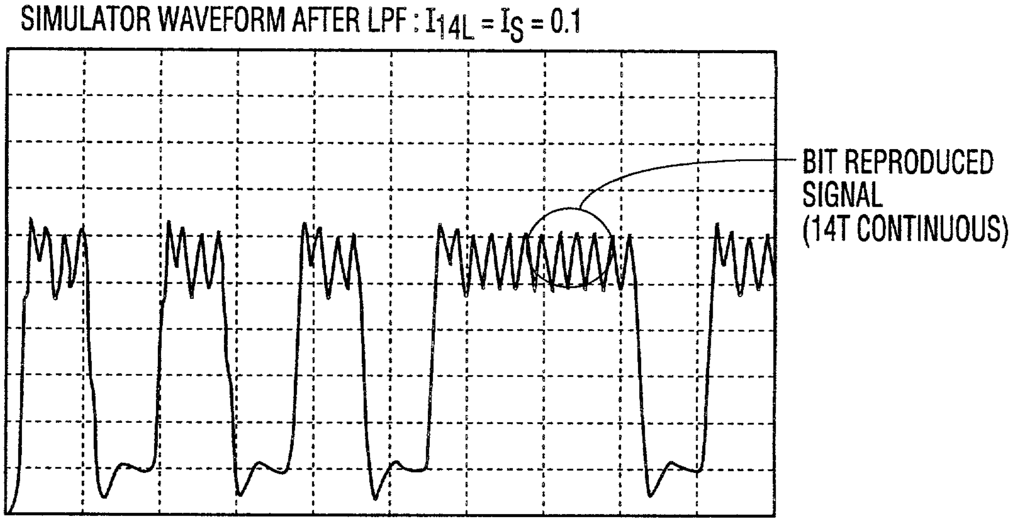


FIG. 35B

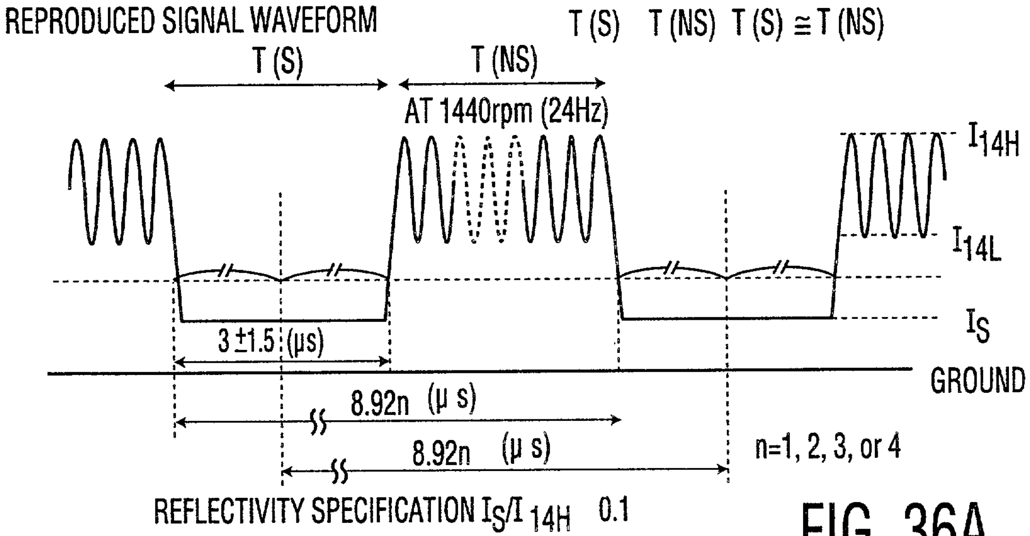


FIG. 36A

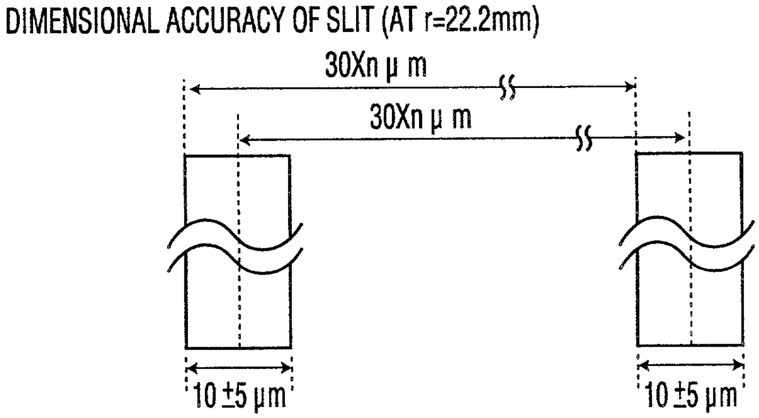


FIG. 36B

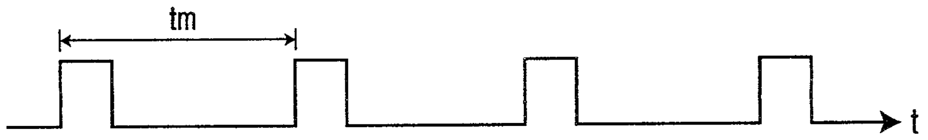


FIG. 36C

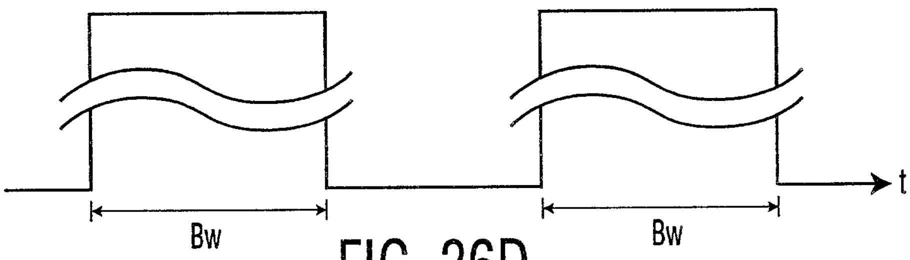


FIG. 36D

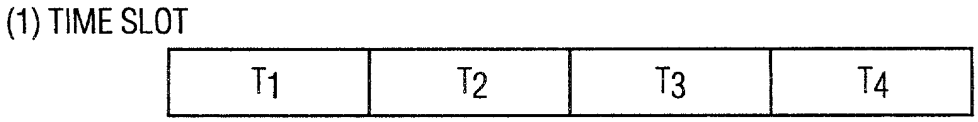


FIG. 37A

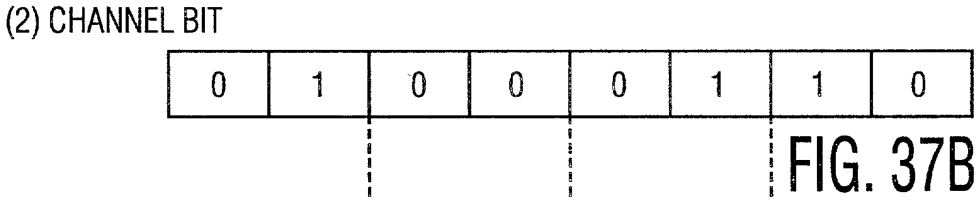


FIG. 37B

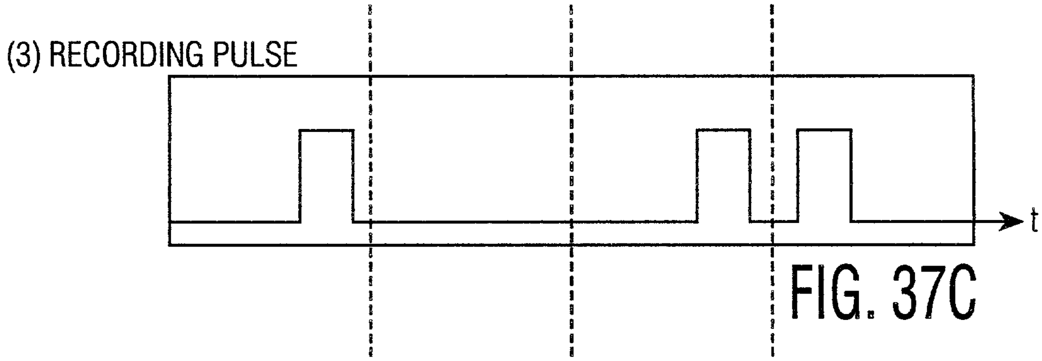


FIG. 37C

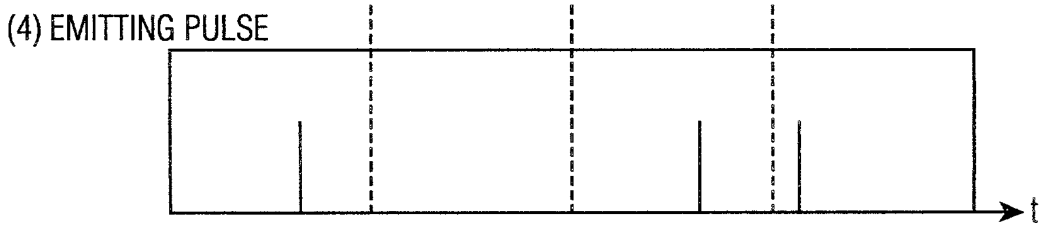


FIG. 37D

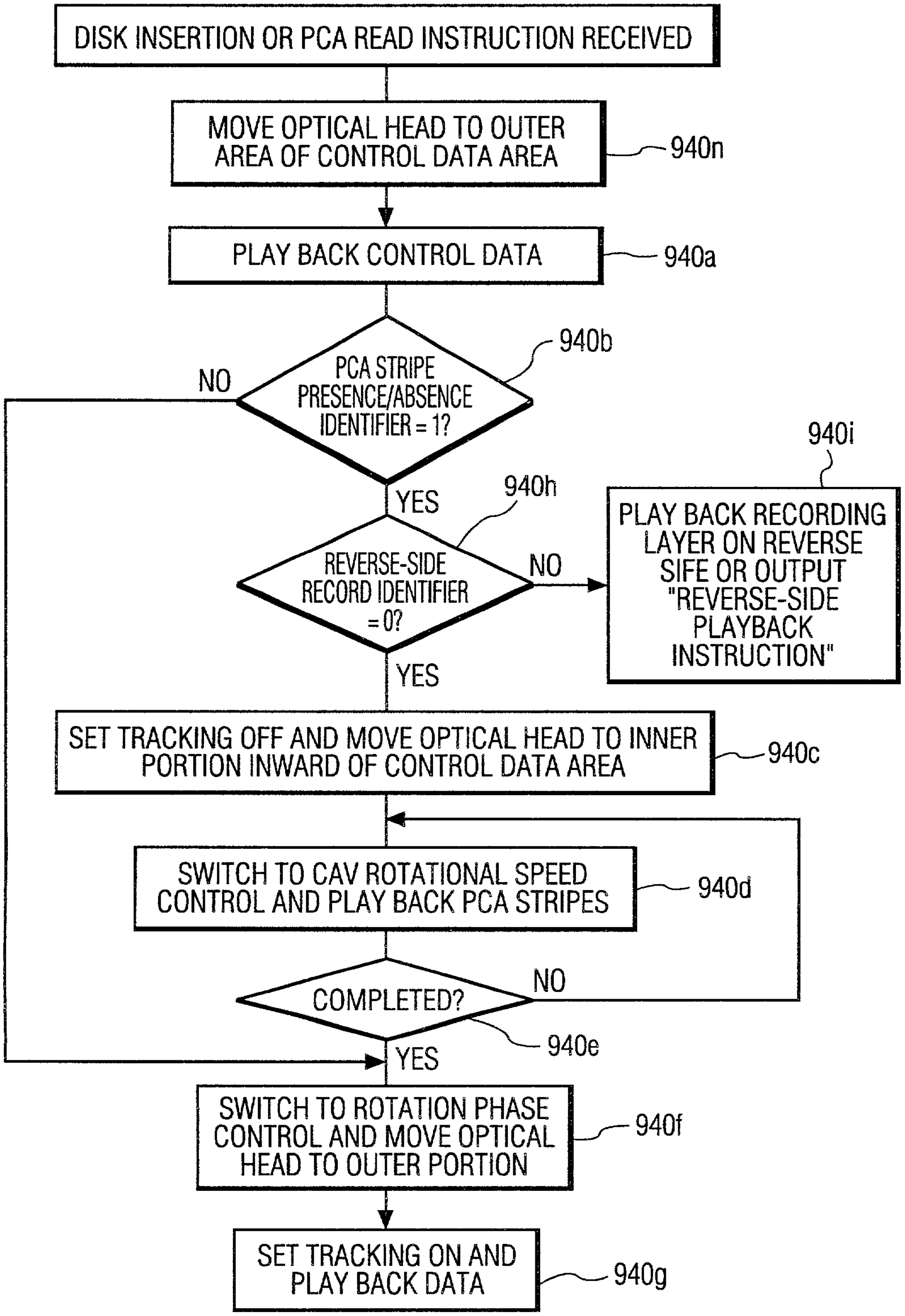

DISK INSERTION OR PCA READ INSTRUCTION RECEIVED
MOVE OPTICAL HEAD TO OUTER AREA OF CONTROL DATA AREA
940n
PLAY BACK CONTROL DATA
940a
940b
NO
PCA STRIPE PRESENCE/ABSENCE IDENTIFIER = 1?
940i
YES
940h
PLAY BACK RECORDING LAYER ON REVERSE SIFE OR OUTPUT "REVERSE-SIDE PLAYBACK INSTRUCTION"
REVERSE-SIDE RECORD IDENTIFIER = 0?
NO
YES
SET TRACKING OFF AND MOVE OPTICAL HEAD TO INNER PORTION INWARD OF CONTROL DATA AREA
940c
SWITCH TO CAV ROTATIONAL SPEED CONTROL AND PLAY BACK PCA STRIPES
940d
NO
COMPLETED?
940e
YES
SWITCH TO ROTATION PHASE CONTROL AND MOVE OPTICAL HEAD TO OUTER PORTION
940f
SET TRACKING ON AND PLAY BACK DATA
940g

FIG. 38

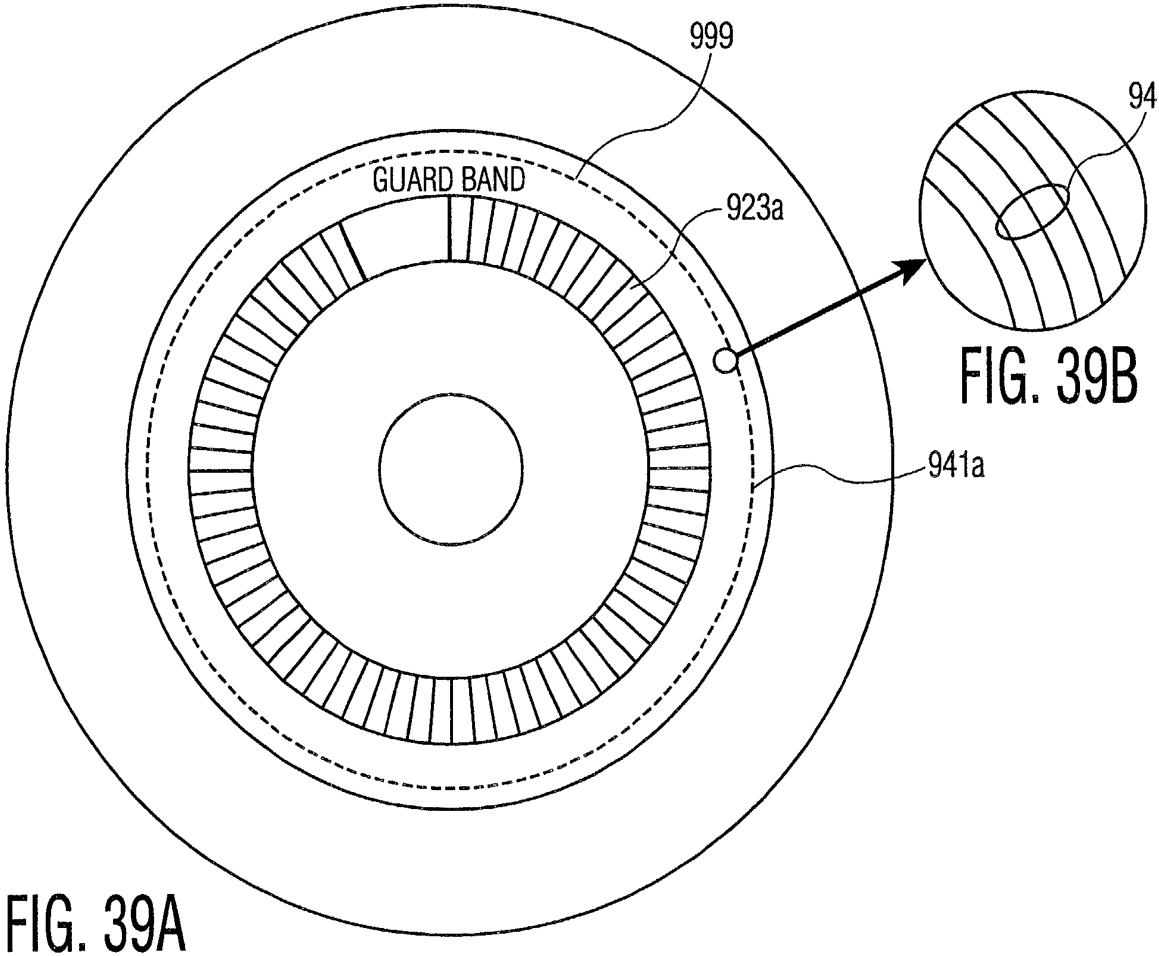


FIG. 39A

FIG. 39B

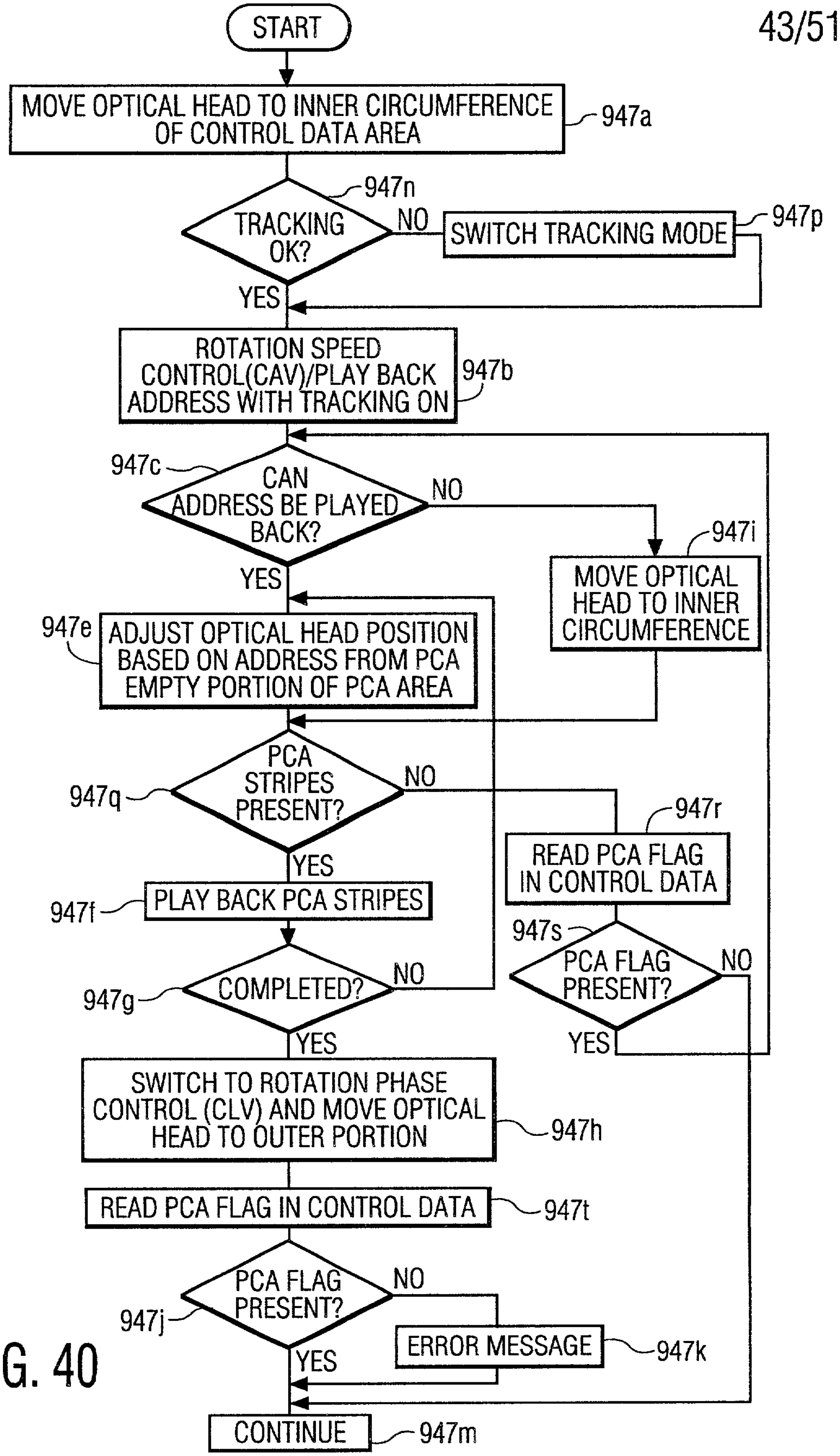

START
MOVE OPTICAL HEAD TO INNER CIRCUMFERENCE OF CONTROL DATA AREA
947a
947n
TRACKING OK?
NO
SWITCH TRACKING MODE
947p
YES
ROTATION SPEED CONTROL(CAV)/PLAY BACK ADDRESS WITH TRACKING ON
947b
947c
CAN ADDRESS BE PLAYED BACK?
NO
947i
MOVE OPTICAL HEAD TO INNER CIRCUMFERENCE
YES
947e
ADJUST OPTICAL HEAD POSITION BASED ON ADDRESS FROM PCA EMPTY PORTION OF PCA AREA
947q
PCA STRIPES PRESENT?
NO
947r
READ PCA FLAG IN CONTROL DATA
YES
947f
PLAY BACK PCA STRIPES
947s
PCA FLAG PRESENT?
NO
947g
COMPLETED?
NO
YES
YES
SWITCH TO ROTATION PHASE CONTROL (CLV) AND MOVE OPTICAL HEAD TO OUTER PORTION
947h
READ PCA FLAG IN CONTROL DATA
947t
PCA FLAG PRESENT?
NO
947j
ERROR MESSAGE
947k
YES
CONTINUE
947m

FIG. 40

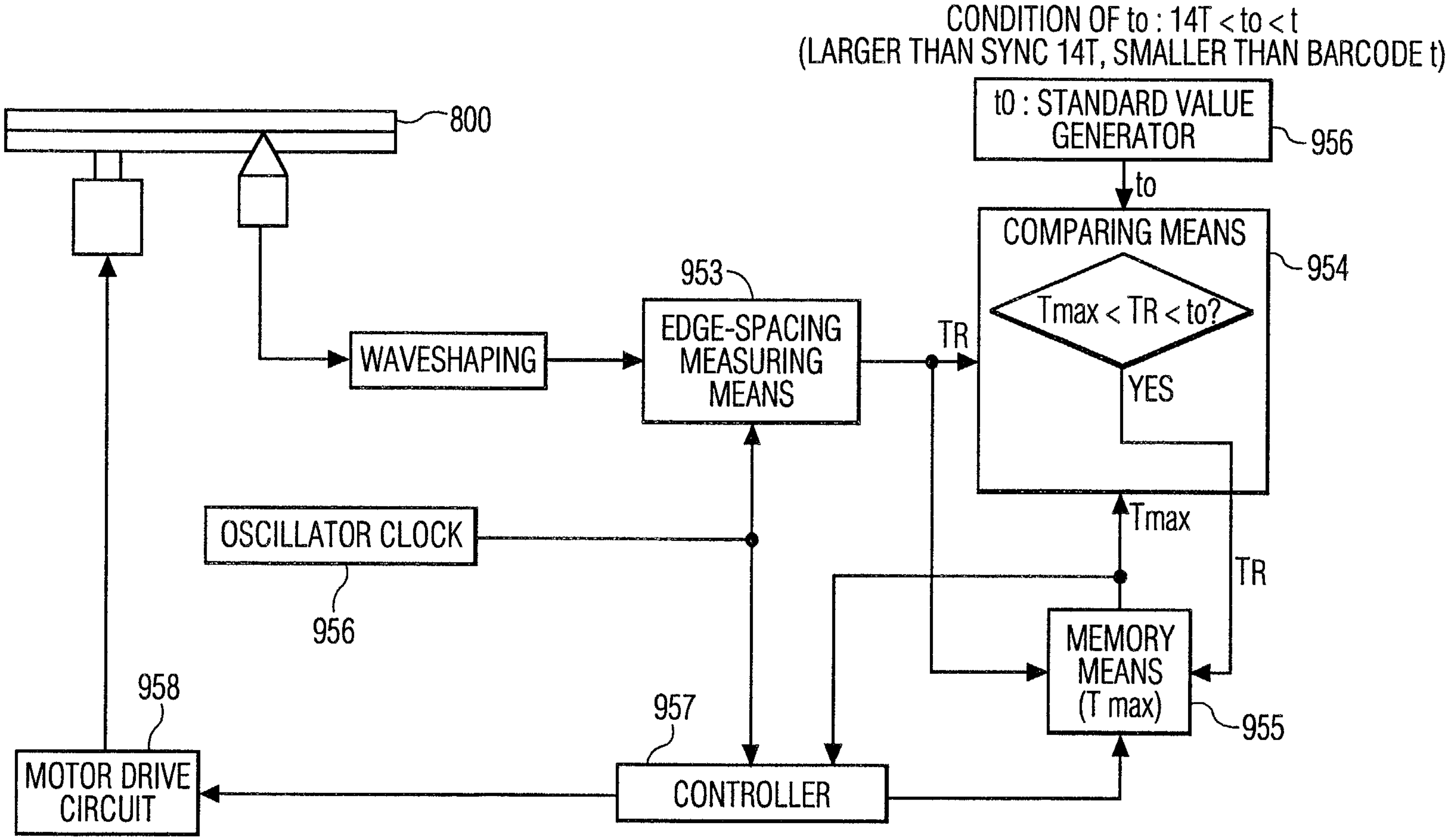

CONDITION OF to : 14T < to < t
(LARGER THAN SYNC 14T, SMALLER THAN BARCODE t)
t0 : STANDARD VALUE GENERATOR
956
to
COMPARING MEANS
954
Tmax < TR < to?
YES
TR
Tmax
TR
MEMORY MEANS (T max)
955
800
WAVESHAPING
953
EDGE-SPACING MEASURING MEANS
OSCILLATOR CLOCK
956
958
MOTOR DRIVE CIRCUIT
957
CONTROLLER

FIG. 41

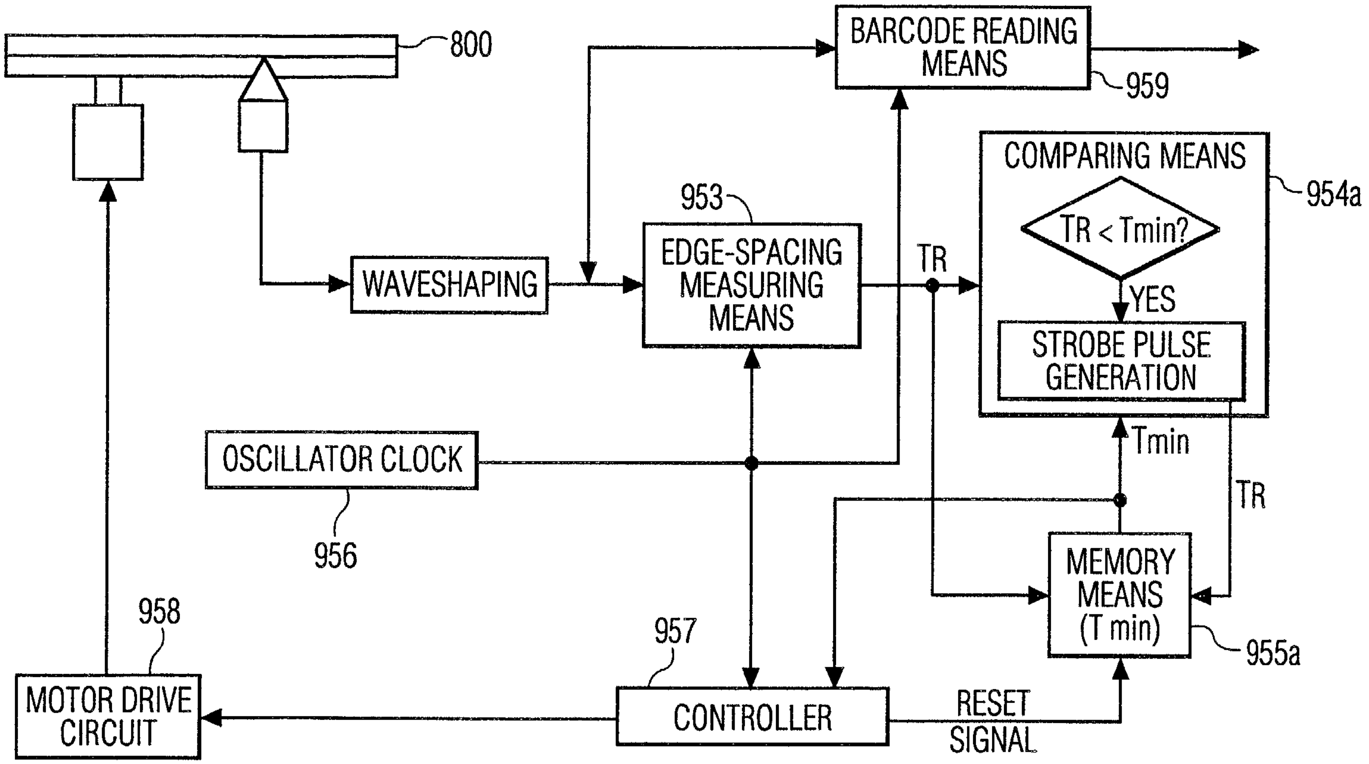

800
BARCODE READING MEANS
959
COMPARING MEANS
954a
TR < Tmin?
YES
STROBE PULSE GENERATION
953
EDGE-SPACING MEASURING MEANS
WAVESHAPING
TR
OSCILLATOR CLOCK
956
Tmin
TR
MEMORY MEANS (T min)
955a
958
957
MOTOR DRIVE CIRCUIT
CONTROLLER
RESET SIGNAL

FIG. 42

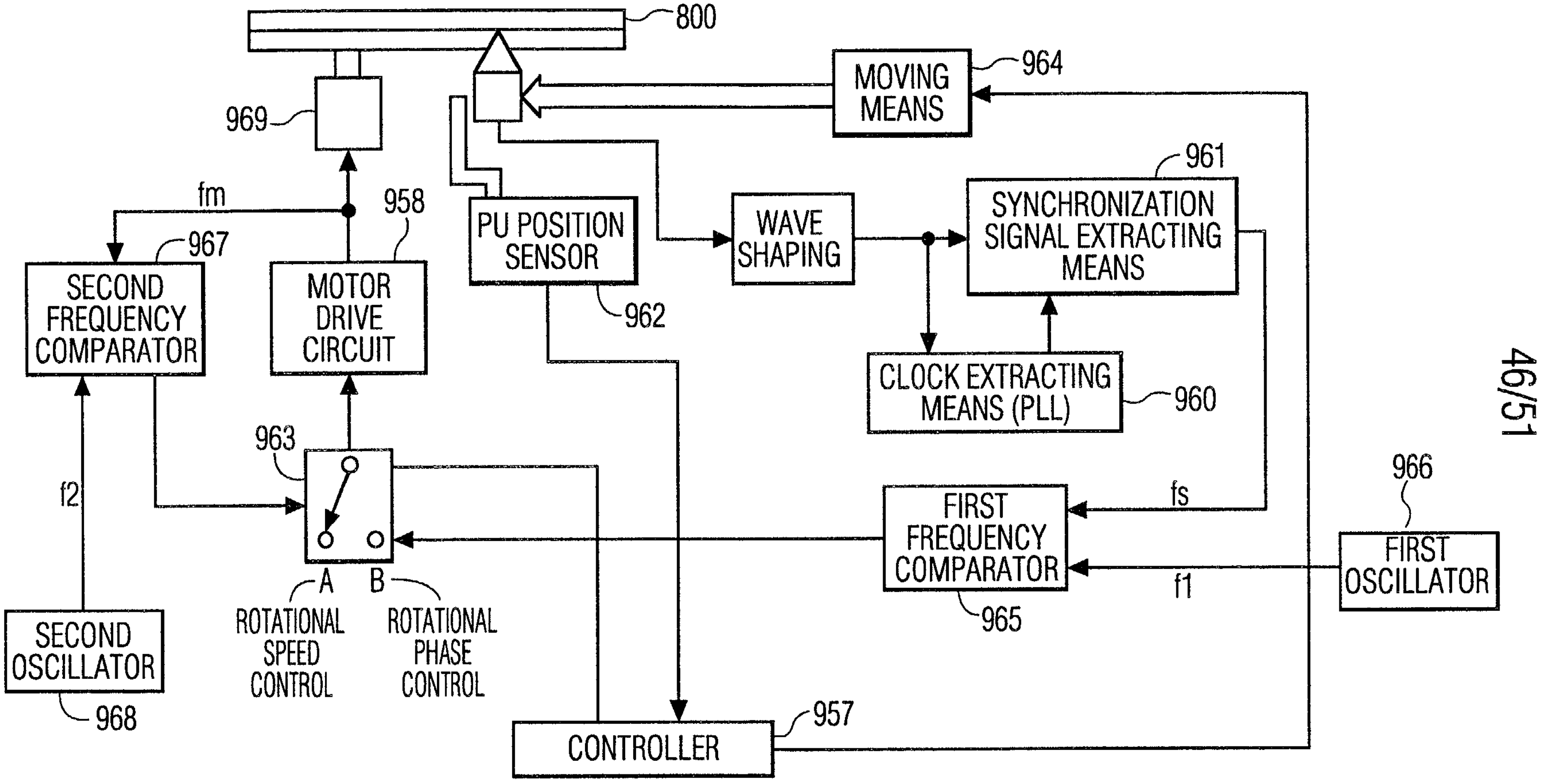

800
969
964
MOVING MEANS
961
SYNCHRONIZATION SIGNAL EXTRACTING MEANS
fm
958
PU POSITION SENSOR
WAVE SHAPING
967
SECOND FREQUENCY COMPARATOR
MOTOR DRIVE CIRCUIT
962
CLOCK EXTRACTING MEANS (PLL)
960
963
966
fs
f2
FIRST FREQUENCY COMPARATOR
FIRST OSCILLATOR
A
B
f1
ROTATIONAL SPEED CONTROL
ROTATIONAL PHASE CONTROL
965
SECOND OSCILLATOR
968
957
CONTROLLER

FIG. 43

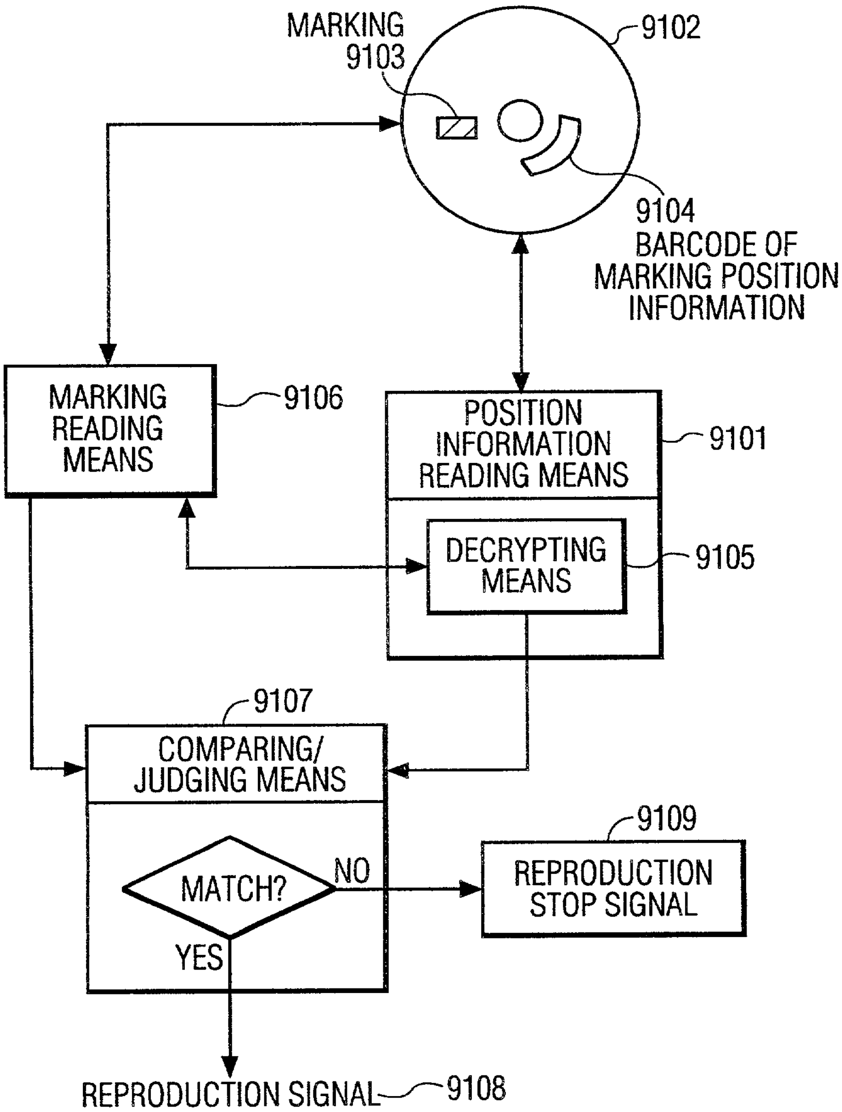

MARKING
9103
9102
9104
BARCODE OF
MARKING POSITION
INFORMATION
MARKING
READING
MEANS
9106
POSITION
INFORMATION
READING MEANS
9101
DECRYPTING
MEANS
9105
9107
COMPARING/
JUDGING MEANS
MATCH?
NO
YES
9109
REPRODUCTION
STOP SIGNAL
REPRODUCTION SIGNAL
9108

FIG. 44

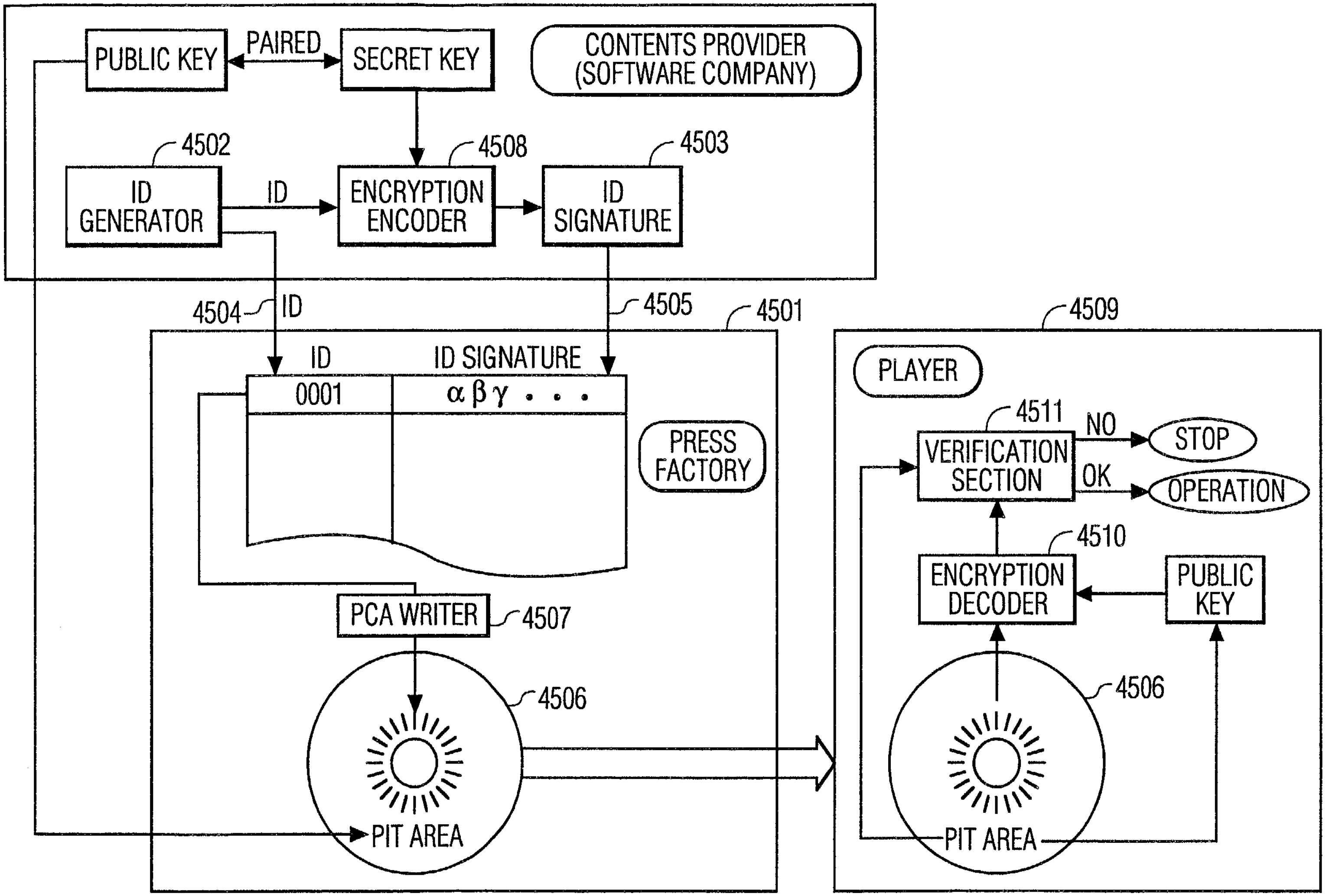

CONTENTS PROVIDER (SOFTWARE COMPANY)
PUBLIC KEY
PAIRED
SECRET KEY
4502
ID GENERATOR
ID
4508
ENCRYPTION ENCODER
4503
ID SIGNATURE
4504
ID
4505
4501
ID
ID SIGNATURE
0001
α β γ . . .
PRESS FACTORY
PCA WRITER
4507
4506
PIT AREA
4509
PLAYER
4511
VERIFICATION SECTION
NO
STOP
OK
OPERATION
4510
ENCRYPTION DECODER
PUBLIC KEY
4506
PIT AREA

FIG. 45

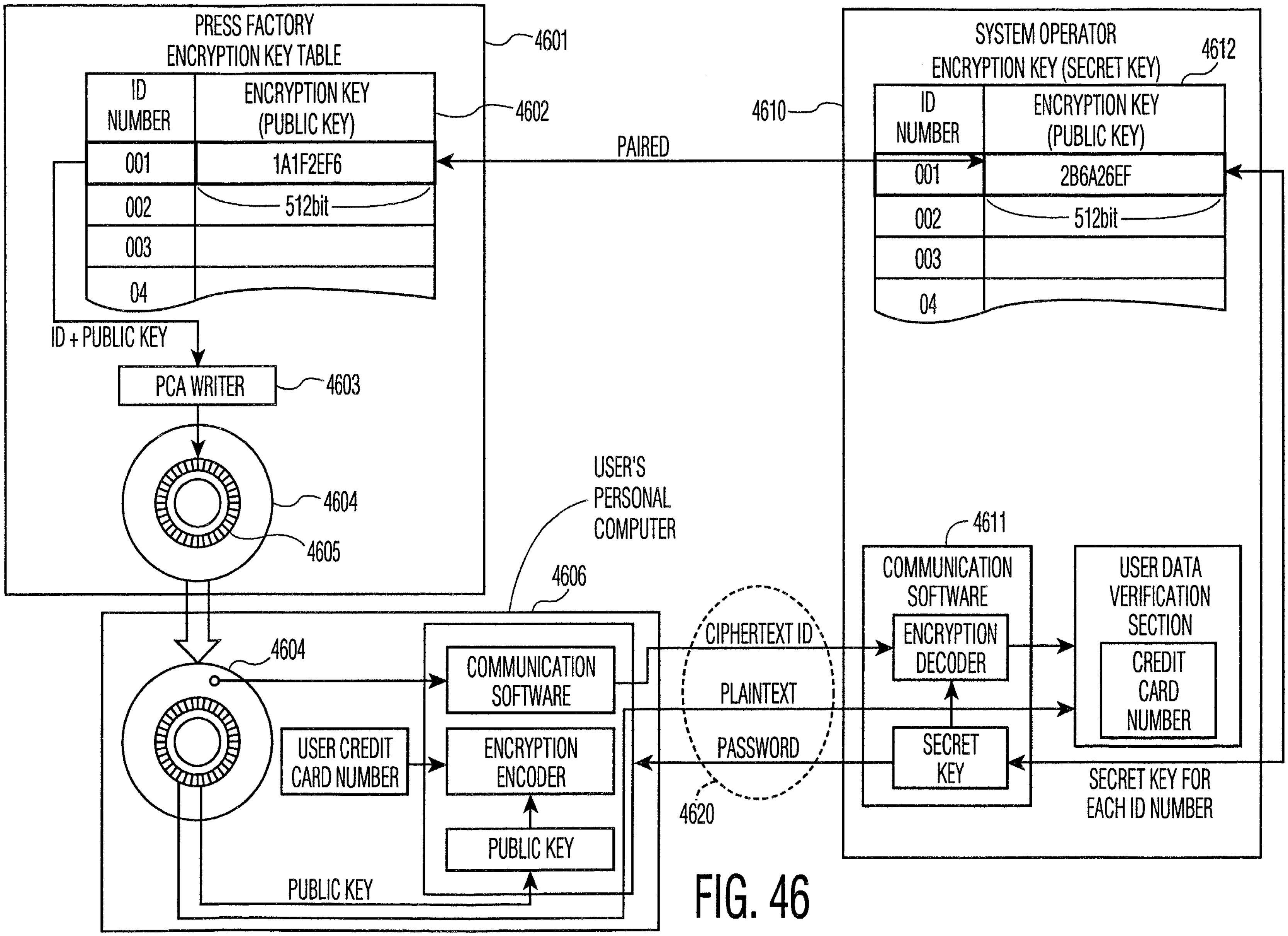

PRESS FACTORY
ENCRYPTION KEY TABLE
4601
ID NUMBER
ENCRYPTION KEY (PUBLIC KEY)
4602
001
1A1F2EF6
002
512bit
003
04
ID + PUBLIC KEY
PCA WRITER
4603
4604
4605
PAIRED
4610
SYSTEM OPERATOR
ENCRYPTION KEY (SECRET KEY)
4612
ID NUMBER
ENCRYPTION KEY (PUBLIC KEY)
001
2B6A26EF
002
512bit
003
04
USER'S PERSONAL COMPUTER
4606
4604
COMMUNICATION SOFTWARE
USER CREDIT CARD NUMBER
ENCRYPTION ENCODER
PUBLIC KEY
PUBLIC KEY
CIPHERTEXT ID
PLAINTEXT
PASSWORD
4620
4611
COMMUNICATION SOFTWARE
ENCRYPTION DECODER
SECRET KEY
USER DATA VERIFICATION SECTION
CREDIT CARD NUMBER
SECRET KEY FOR EACH ID NUMBER

FIG. 46

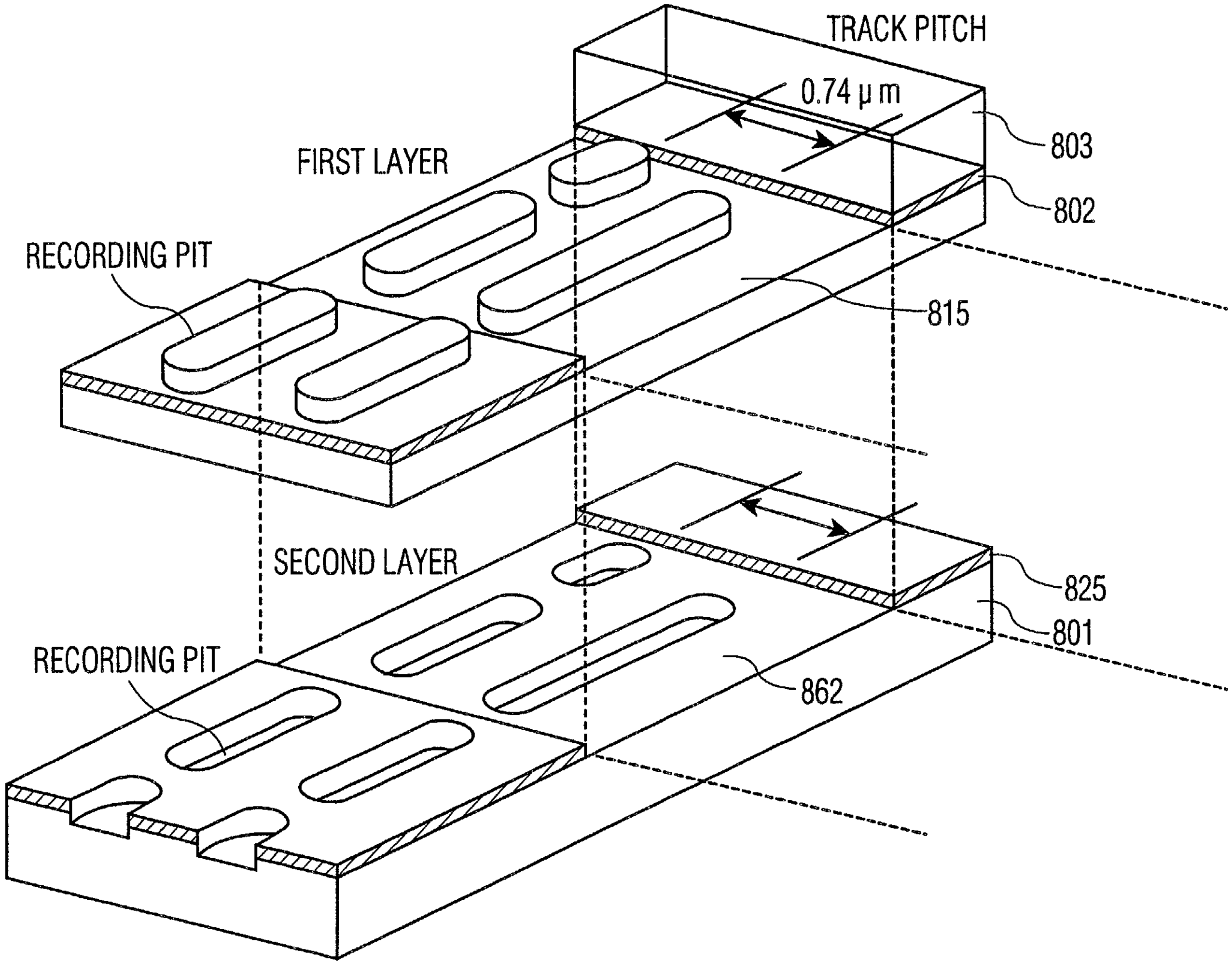

TRACK PITCH
0.74 μ m
803
802
FIRST LAYER
RECORDING PIT
815
SECOND LAYER
825
801
RECORDING PIT
862

FIG. 47

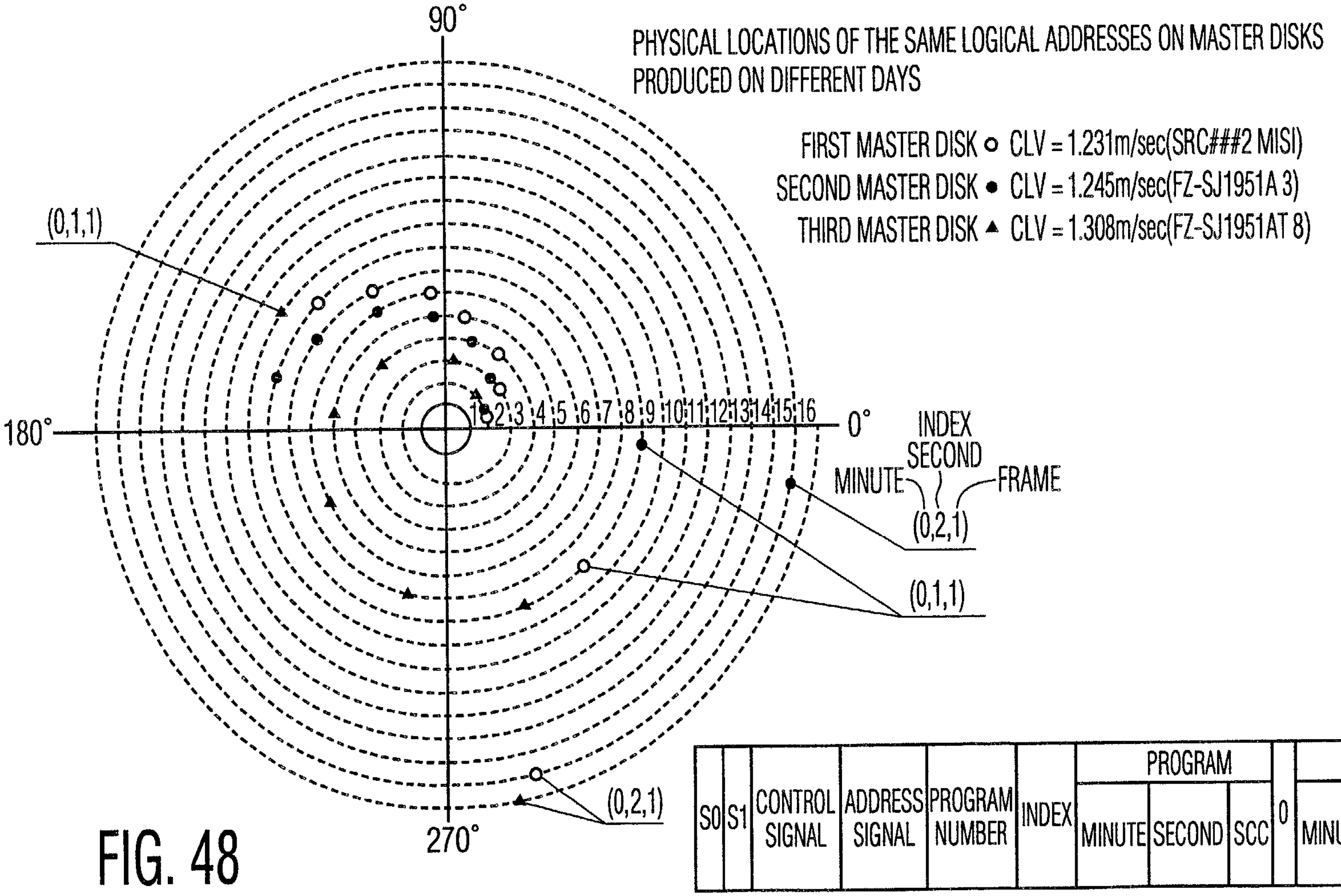


FIG. 48

S0	S1	CONTROL SIGNAL	ADDRESS SIGNAL	PROGRAM NUMBER	INDEX	PROGRAM			0	TOTAL			ERROR CORRECTING CODE CRCC
						MINUTE	SECOND	SCC		MINUTE	SECOND	SCC	